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WITH SUPPLEMENT

LONDON

BRITISH MEDICAL ASSOCIATION

TAVISTOCK SQUARE

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by them both men and women
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BRITISH MEDICAL JOURNAL

LONDON SATURDAY MARCH 22 1941

CRUSH INJURIES WITH IMPAIRMENT OF RENAL FUNCTION

BY

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[WITH SPECIAL PLATE]

Amongst air-raid casualties seen at this hospital have been four cases of crush injury of the limbs which, because of the general similarity of their clinical course, were thought to represent a specific and hitherto unreported syndrome, and one which has been and will be seen elsewhere during the war. Such a condition may have been observed in civil practice, but we have been unable to find any account of it in the literature. The cases are of interest on account of the problem propounded by both pathogenesis and treatment. The picture presented by these four cases, and substantiated by others, is briefly as follows:

The patient has been buried for several hours with pressure on a limb. On admission he looks in good condition except for swelling of the limb, some local anaesthesia, and wheals. The haemoglobin, however, is raised, and a few hours later, despite vasoconstriction, made manifest by pallor, coldness, and sweating, the blood pressure falls. This is restored to pre-shock level by (often multiple) transfusions of serum, plasma, or, occasionally, blood. Anxiety may now arise concerning the circulation in the injured limb, which may show diminution of arterial pulsation distally, accompanied by all the changes of incipient gangrene. Signs of renal damage soon appear, and progress even though the crushed limb be amputated. The urinary output, initially small, owing perhaps to the severity of the shock, diminishes further. The urine contains albumin and many dark brown or black granular casts. These later decrease in number. The patient is alternately drowsy and anxiously aware of the severity of his illness. Slight generalized oedema, thirst, and incessant vomiting develop, and the blood pressure often remains slightly raised. The blood urea and potassium, raised at an early stage, become progressively higher, and death occurs comparatively suddenly, frequently within a week. Necropsy reveals necrosis of muscle and, in the renal tubules, degenerative changes and casts containing brown pigment.

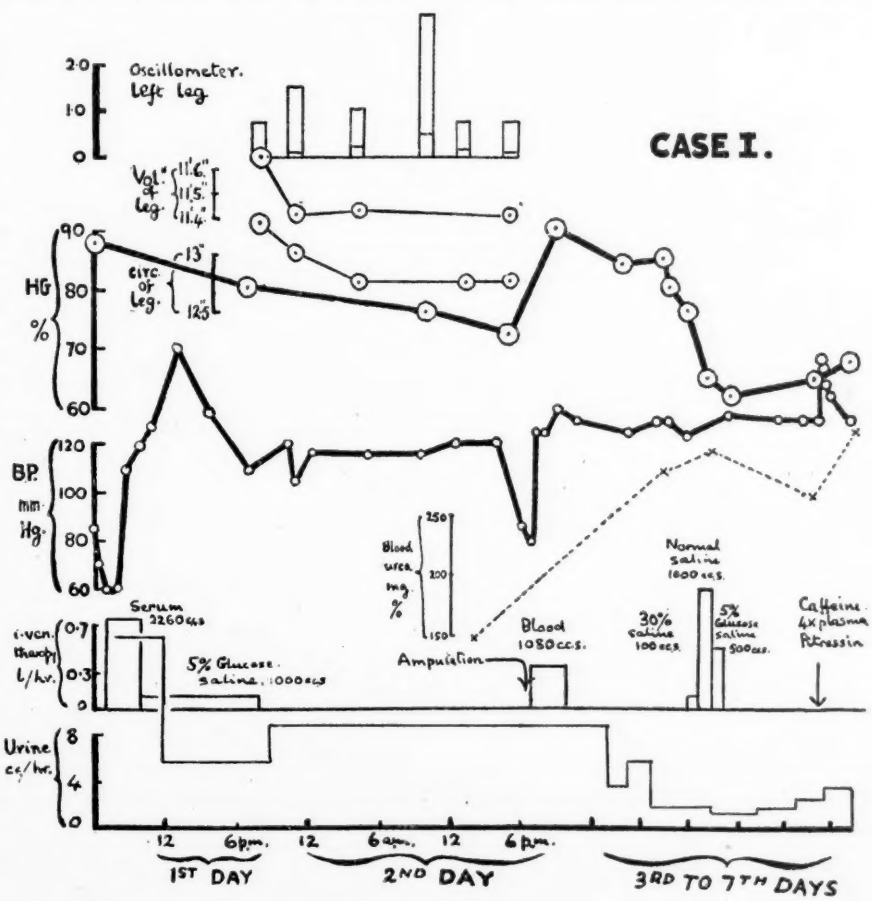

CHART I.—Case I.

Case 1

A female aged 17 had been buried for nine hours with heavy masonry lying across the left leg. On admission she showed slight bruises generally, and multiple superficial abrasions below the left knee. The leg was swollen and sensation was impaired at the ankle, where all power and movement were lost. Other limbs appeared undamaged. The skin was pallid and clammy; the blood pressure was 85/70 mm. Hg. The clinical course is shown on Chart I. Recalcified plasma–saline (Clegg and Dible, 1940) (subsequently referred to as "serum"), followed by 5% glucose–saline,

brought the blood pressure from 60 mm. Hg, where it had remained for one and a half hours, to 160 mm. Hg. Urine was passed containing neither albumin nor blood.

By 7 p.m. the haemoglobin concentration had fallen. Blisters were forming on the left knee, where there was a joint effusion. Less oedema of the leg was now present than on admission; measurements were made of leg circumference, of leg volume (by a tape method),* and of pulsation by means of an oscillometer. During the next twenty-four hours the volume and circumference of the leg decreased. However, the oscillometer readings, after a deceptive rise towards normal, fell to the low initial level, even though during this

TABLE I.—*Biochemical Findings in Case 1: Blood*

Date	Time	Urea	Plasma Inorg. P	Plasma Chlorides (as NaCl)	Plasma Proteins				Alkali Reserve	Serum Potassium
					Total	Albumin	Globulin	Fibrinogen		
		mg. per 100 c.cm.	mg. per 100 c.cm.	mg. per 100 c.cm.	gm. per 100 c.cm.	gm. per 100 c.cm.	gm. per 100 c.cm.	gm. per 100 c.cm.	c.cm.	mg. per 100 c.cm.
Dec. 5	2 p.m.	148	—	584	6.9	4.0	2.8	0.1	50	30
,, 7	10.40 a.m.	286	—	498	—	—	—	—	42	—
,, 8	11 a.m.	305	7.3	615[2]	6.2	—	—	—	40	31[3]
,, 10	2.30 p.m.	268	—	575	—	—	—	—	—	33
,, 11	12.20 p.m.[1]	320	7.7	496	6.6	3.7	2.7	0.2	—	34[4]

[1] At death.
[2] Received 1,000 c.cm. of saline.
[3] Uric acid 10.8 mg., creatinine 2 mg., plasma sodium 307 mg.
[4] Serum calcium 9.1 mg.

TABLE II.—*Biochemical Findings in Case 1: Urine*

Date	Time	Volume	Protein	Urea	Chlorides (as NaCl)	Benzidine Reaction	Deposit
		c.cm.	mg. per 100 c.cm.	mg. per 100 c.cm.	mg. per 100 c.cm.		
Dec. 4	12 noon	96	0	—	640	Negative	
	9 p.m.	50	0	—	—	,,	
,, 6	10.30 a.m.	332	60	—	270	Positive	
	5 p.m.	22	350	—	360	,,	Hyaline, red cell, and granular casts
,, 7	7.30 a.m.	80	800	—	560	,,	Pus cells + bacteria
,, 8	11 a.m.	50	1,000	514	520	,,	
,, 9	10 a.m.	30	900	—	480	,,	
	9 a.m.	38	900	570	520	,,	
	5.55 p.m.	4.5	—	720	440		
	6.45 p.m.	14.2	—	680	440		
,, 10	8 p.m.	4.8	—	770	440		
	9 p.m.	3.4	—	750	410		
	10 p.m.	2.2	—	740	420		
,, 11	9.15 a.m.	38	—	770	420		

period the left leg had been bandaged and elevated to 50 degrees on a Thomas splint for two hours. The second specimen of urine still showed neither albumin nor blood.

By 6 p.m. the next day the left leg was cold below the knee and blue, and amputation was proposed. This was done under vinesthene and gas-and-oxygen. Citrated stored blood (Group O) was given during and after operation, restoring the blood pressure, which had temporarily fallen, to the pre-operative level. Urines collected after this showed albumin and gave a positive benzidine reaction; hyaline, granular, and what appeared to be red cell casts were noticed, besides free red corpuscles.

During the next five days the patient continued drowsy and apathetic, from which state she was easily roused by the slightest stimulus to become anxious and apprehensive, without, however, any loss of mental clarity. The output of urine became very small, despite a fluid intake by mouth of between 1.5 and 2.5 litres daily; vomiting continued (between 50 and 250 c.cm. daily). Normal saline (1 litre), 30% saline (100 c.cm.), and 5% glucose-saline, followed later by caffeine benzoate (140 mg.), 85 c.cm. of four-times-normal reconstituted dried serum (obtained from the Medical Research Council serum-drying unit), with, in addition, pitressin 1/100,000, were given intravenously, and hot bottles were applied to the loins. Despite these measures, directed towards restarting urine flow, the patient, whose blood pressure was maintained at 130/70, suddenly collapsed at 12.13 p.m. on the eighth day and died in three minutes. A systolic murmur at the apex and dropped beats had been noticed for forty-eight hours before death, and an electrocardiogram taken forty-one hours before death showed merely low voltage. A second, sixteen hours later, showed widening of QRS, higher voltage, increase in Q_3, and inversion of T_3. Biochemical findings are listed in Tables I and II. Necropsy was performed two and a half hours after death.

SUMMARY OF POST-MORTEM RECORD BY DR. THOMAS BELT

The point of major interest was the condition of the kidneys. They were large, weighing 210 and 230 grammes respectively, rather dark red and firm, quite smooth of surface, having tense capsules due to swelling of the cortices. The cut edges everted; the cut surfaces were wet and glassy owing to oozing of serous fluid. Parts of cortex midway between renal pyramids were blanched by a zonal ischaemia. There was no evidence of ascending infection. The bladder was slightly reddened, and contained a few drops of very thick cloudy urine. Subcutaneous and retroperitoneal tissues oozed serous fluid when cut, indicating a slight generalized oedema. Marked cyanosis was evident in the internal parts, but the skin was pale. Other organs and tissues presented no striking change.

Microscopical Examination.—Kidney: The main change was to be found in the tubules. The convoluted tubules and the loops of Henle were severely damaged. The cytoplasm of the lining epithelium was swollen, frayed, granular, and vacuolated. Individual cells here and there were devitalized and desquamated, while those that remained attached showed fairly frequent mitotic figures. The cast-off cells in various stages of disintegration merged in the lumina with loose collections of eosinophilic debris. In the loops of Henle and the collecting tubules there were numerous casts of dense eosinophilic material, most of which had a brownish colour, as though lightly stained with bile or blood pigment. These casts seemed to be all of the same substance, though their morphological appearance varied a good deal, depending upon the degree of condensation they had undergone. Some looked not unlike collections of disintegrating erythrocytes; others simulated shreds of fibrin or beaded ribbon, while still others were condensed into solid hyaline cylinders. They seemed to be compounded of dead epithelial cells, inspissated albumin, and perhaps hyaline material exuding from the lining of the tubules. One could identify an occasional erythrocyte within the tubules, but, so far as could be determined by histological means, the majority of the casts were not red cell casts, though some of their colour might have been due to haemoglobin. They were probably not of a specific type, as similar casts are to be seen in acute nephritis and other conditions where there seems to have been great reabsorption in the tubules, resulting in a scanty concentrated urine. Some of them were surrounded and invaded by leucocytes, and, in the lower reaches of the straight tubules, leucocytes were sometimes the predominant constituent. Here and there a cast-filled tubule was undergoing disintegration and was surrounded by inflammatory cells. Stains for iron were negative. Fatty changes were absent. The glomeruli showed no obvious structural change, though the frequent presence of albuminous material in Bowman's capsule suggests that they had not escaped injury. The glomerular tufts contained relatively little blood, but the vessels of the medullary parts were greatly engorged.

Other Tissues.—Thyroid: Signs of commencing activity with increased height of cells and many mitoses. Liver: cloudy

* Worked out in conjunction with D. K. Hill. An inextensible tape of width (w) is wound round the limb without overlapping. The length of tape (L), thus enclosing a certain volume (V) by a number of turns (n), is given by the formula:

$$L = \sqrt{\frac{4\Pi nV}{kw}}$$

where k is a constant dependent on the shape of the leg. In Case 1 direct measurement of volume by water displacement gave k a value of 0.90.

swelling but no necrosis. Adrenal: patchy loss of cortical lipoid. Heart: vacuolation of neuromuscular fibres (bundle of His). Muscles of right leg: not abnormal.

The amputated leg showed haemorrhage in the popliteal fossa around the artery, extending along the intermuscular fascial planes. There was no oedema beneath the deep fascia, but slight superficial oedema with punctate haemorrhage was present over the pressure areas in the skin. There was a haemarthrosis of the knee-joint, with cracks in the patella and tibial cartilages, extending down across the bone of the tibial condyle. Sections of artery showed no lesion; sections of muscle (which macroscopically looked normal) revealed a few fibres (1%) undergoing necrosis, with loss of striation and staining power.

Case II

A female aged 45 had been crushed under a collapsed building for six hours. On admission there was a large scalp wound and lacerations and bruises of both legs, on which debris had been pressing. Both calves were extremely hard, swollen, and tense. The blood pressure was 130/98, and, despite considerable bleeding from the scalp, the haemoglobin amounted to 92%; the pulse was 130. (See Chart II.) Measurements were taken of leg volume. Pulsation (oscillometer) was decreased in both legs. The scalp wound was sutured under gas-and-oxygen and ether.

Two hours later haemoconcentration developed and the blood pressure fell. Repeated infusions of "serum," plasma, and saline restored the blood pressure to 115 mm. Hg; then, following a transfusion of citrated stored blood, to the abnormally high level of 160 mm. Hg. With the rise in blood pressure the volumes of both legs increased, and the oscillometric readings fell. Dark smoky urine was obtained by catheter next day, showing albumin and red cell and hyaline casts.

At 2 p.m. she was vomiting and had oedema of the face, eyelids, and arms as well as the legs. Venous blood showed raised urea (115 mg.), plasma chloride (801 mg. as NaCl), and serum potassium (28 mg.), and a lowered CO_2-combining power (41 c.cm. per 100 c.cm.). Pulsation had returned in the right leg but not yet in the left. The chloride content of the body was therefore reduced (by sweating, purgation, and replacement of gastric juice by sodium bicarbonate) and the oedema disappeared, except from the legs. During the next three days her condition remained the same: the blood pressure reached as high as 168/104, and, while the plasma chloride and alkali reserve fell, urea, phosphates, and potassium steadily rose. Urinary output was very low (50 c.cm. daily) in spite of a daily intake of between 1½ and 2 litres. The urine became blood-free but infected (catheterization), and showed a low chloride concentration.

On the sixth day at 11.15 p.m. the patient became distressed, cold, and wet with sweat: a systolic murmur was heard at the apex and the blood pressure fell to 106/85. An electrocardiogram taken before this (at 7 p.m.) showed bundle-branch block. The pulse suddenly fell to 70 (previously steady at 100) and showed dropped beats. She died at 12.10 a.m. on the seventh day. Biochemical findings are shown in Tables III and IV.

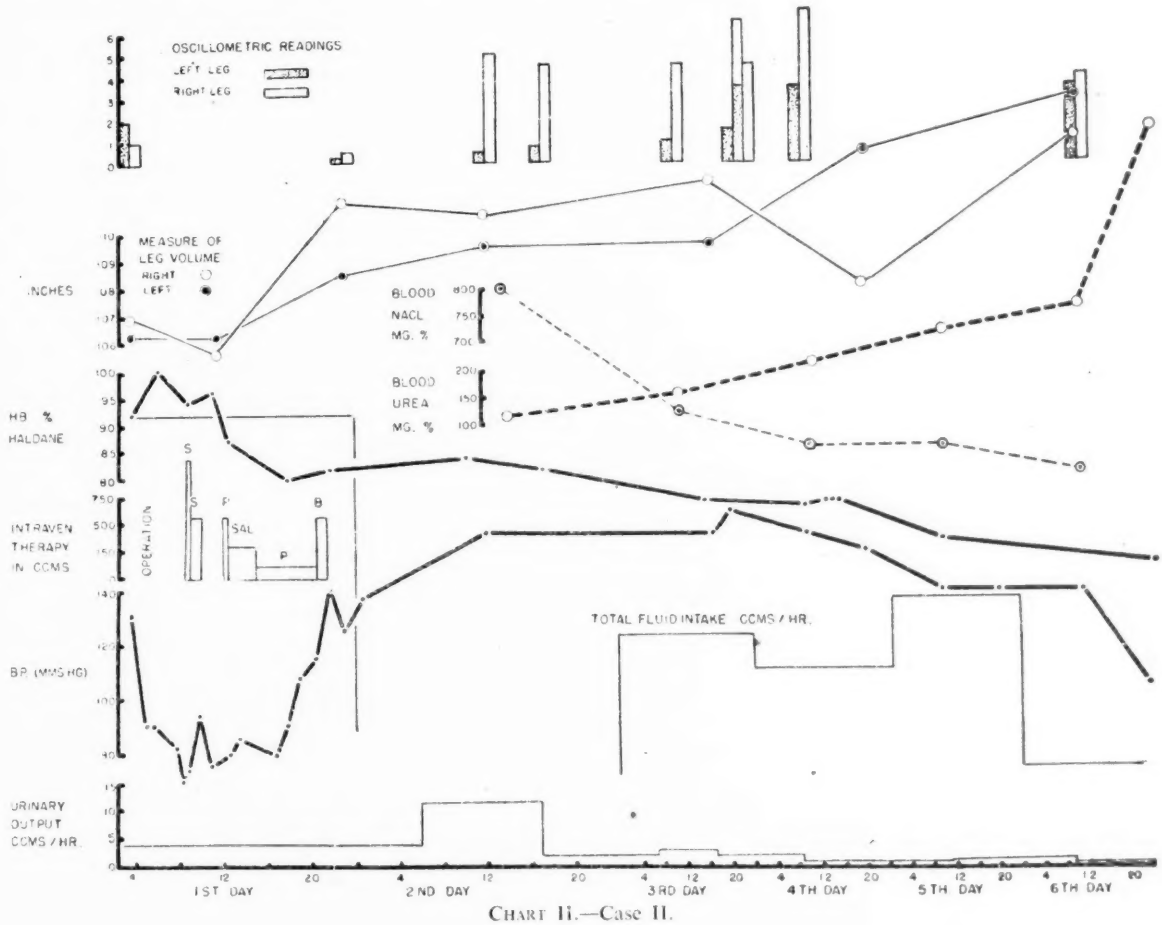

CHART II.—Case II.

TABLE III.—*Biochemical Findings in Case II: Blood*

Date	Time	Urea	Plasma norg. P	Plasma Chlorides (as NaCl)	Plasma Protein	Serum Potassium	Alkali Reserve
		mg. per 100 c.cm.	mg. per 100 c.cm.	gm. per 100 c.cm.	gm. per 100 c.cm.	mg. per 100 c.cm.	c.cm.
Dec. 5	2 p.m.	115	—	801	7.1	28	41
,, 6	11 a.m.	156	—	572	—	—	40
,, 7	11 a.m.	214	11.1	513	—	—	40
,, 8*	10.30 a.m.	270	9.2	513	6.9	—	34
,, 9	11 a.m.	314	12.9	464	—	32	30
	at death	640	—	—	—	34	30

* Uric acid 10 mg., creatinine 2 mg., and serum sodium 290 mg.

TABLE IV.—*Biochemical Findings in Case II: Urine*

Date	Time	Volume c.cm.	Protein mg. per 100 c.cm.	Urea mg. per 100 c.cm.	Chlorides (as NaCl) mg. per 100 c.cm.	Benzidine Reaction	Deposit
Dec. 5	6 a.m.	92	400	—	160	Positive	Dark and smoky. Many blood casts. Some red cells, few granular casts
	5.15 p.m.	134	—	—	180	,,	
,, 6	7.30 a.m.	25	400	—	240	,,	Red cells. Red cell casts. Pus cells
	5 p.m.	20	300	—	180	,,	
,, 7	8.30 a.m.	21	160	—	180	,,	
,, 8	11.30 a.m.	15	400	520	240	,,	Pus. Micro-organisms. Few red cells
,, 9	10 a.m.	16	900	—	320	,,	
	at death	16	800	670	240	,,	

SUMMARY OF POST-MORTEM RECORD BY DR. THOMAS BELT

Necropsy twelve hours after death: Calf muscles on both sides showed widespread necrosis. They were blanched and swollen as if parboiled, and mottled with haemorrhagic areas. The vessels of the legs were apparently undamaged. The kidneys were relatively large (weighing 190 and 170 grammes), smooth, tense, and dark red. There was no pyelitis. The bladder mucosa was slightly reddened; the liver was swollen (1,830 grammes); and the lungs were slightly oedematous (500 grammes each).

Microscopical Examination.—Kidney changes were very much like those in Case I. There were perhaps more leucocytes in the tubules, and these occasionally extended right up into the cortex. The liver showed cloudy swelling but no necrosis. Muscle displayed widespread necrosis, chiefly coagulative but becoming liquefactive in small foci. There was much patchy haemorrhage and polymorph reaction in disintegrating areas, but no bacteria. Some small vessels in the section showed necrosis of the wall. The pancreas had a few patches of fat necrosis, and the adrenal gland showed patchy loss of cortical lipoid. Other tissues appeared normal.

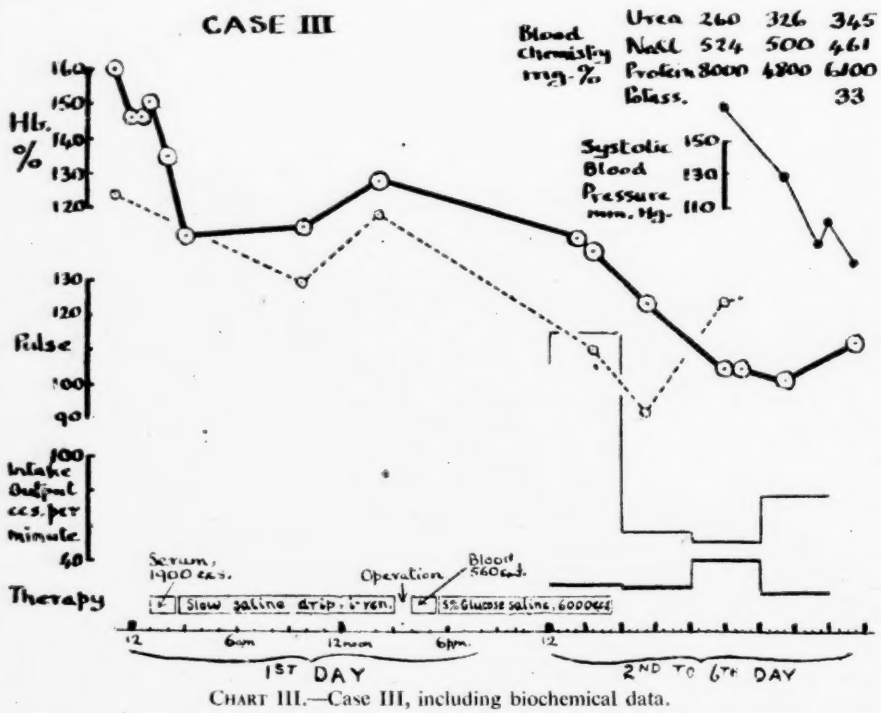

CHART III.—Case III, including biochemical data.

Case III

A male aged 34 was pinned down by beams across shoulders, arms, and thighs for twelve hours. On admission he was pale and shocked, with great swelling of both arms and thighs, and skin-whealing at pressure sites. There was occasional vomiting (about 120 c.cm. daily). The blood pressure could not be taken on account of the swelling. 1,900 c.cm. of "serum" was given intravenously over ninety minutes, reducing the haemoglobin from 160 to 112%. (See Chart III.) Next day the left arm appeared greatly swollen, and the hand blue, cold, and pulseless. An incision was therefore made from mid-arm to below the elbow, relieving the tension beneath the deep fascia so that the brachial artery again began to pulsate. This was followed by a transfusion of 460 c.cm. of blood (Group O). Urine was passed—specific gravity 1015—containing albumin and blood but no casts. On the third day the left hand was warm but still devoid of sensation and power: there was oedema of both thighs, but a radiograph showed that there was no bony lesion. The patient continued to vomit about 100 c.cm. daily; 6 litres of 5% glucose–saline had been given intravenously over this and the previous day. There was some incontinence of urine, of which, however, 655 c.cm. was collected. On the fourth day, despite a fluid intake of 1,340 c.cm., 590 c.cm. of urine was passed, still containing albumin. At 5 p.m. the temperature rose suddenly to 103.4°, and there was some redness around the site of the intravenous puncture. Sulphapyridine by mouth was started. On the fifth day vomiting, dyspnoea, and slight generalized oedema occurred, with crepitations at both bases and a pleuro-pericardial friction rub. A radiograph revealed slight basal congestion only; an electrocardiogram showed right axis deviation; the blood pressure was abnormally high (170–180 mm. Hg), and, despite a urinary output of 990 c.cm. in the day (on an intake of 1,230 c.cm.), the blood urea was 260 mg., the total plasma protein 8.0 grammes, and the plasma chlorides (as NaCl) 500 mg. per 100 c.cm.

During the sixth day the blood pressure fell progressively without further concentration. At 8 p.m. the patient had become delirious and disorientated, and the pulse rapid. The skin became cold, wet, and cyanosed. Coarse crepitations were heard at both bases: there was incontinence of urine, of which 530 c.cm. was collected, showing albumin and numerous red cells but no casts in the deposit. Oxygen was given. The fluid intake was 1,860 c.cm. The blood urea was 326 mg., the total plasma proteins 4.8 grammes, and the plasma chlorides (as NaCl) 500 mg. per 100 c.cm.

Death occurred on the seventh day. 160 minutes before death the blood urea was 345 mg., the total plasma proteins 6.1 grammes, the plasma chlorides (as NaCl) 461 mg., and the serum potassium 33 mg. per 100 c.cm.

SUMMARY OF POST-MORTEM RECORD BY DR. THOMAS BELT

Necropsy showed staphylococcal pyaemia due to thrombophlebitis of saphenous veins. There was extensive crushing of leg muscles. Microscopically, tubular changes in the kidneys resembled those of Cases I and II. There were numerous casts of similar character, but the picture was somewhat complicated by the presence of a few small pyaemic abscesses.

Case IV

A male aged 16 was buried under a collapsed house for eight hours, the left thigh being pinned down by a heavy load of masonry. On admission the systolic blood pressure was 140 mm. Hg, and superficial abrasions were present on the left thigh, later becoming whealed. On getting out of bed that afternoon he fainted. At 8 p.m. he suddenly collapsed; the haemoglobin had risen to 140% and the blood

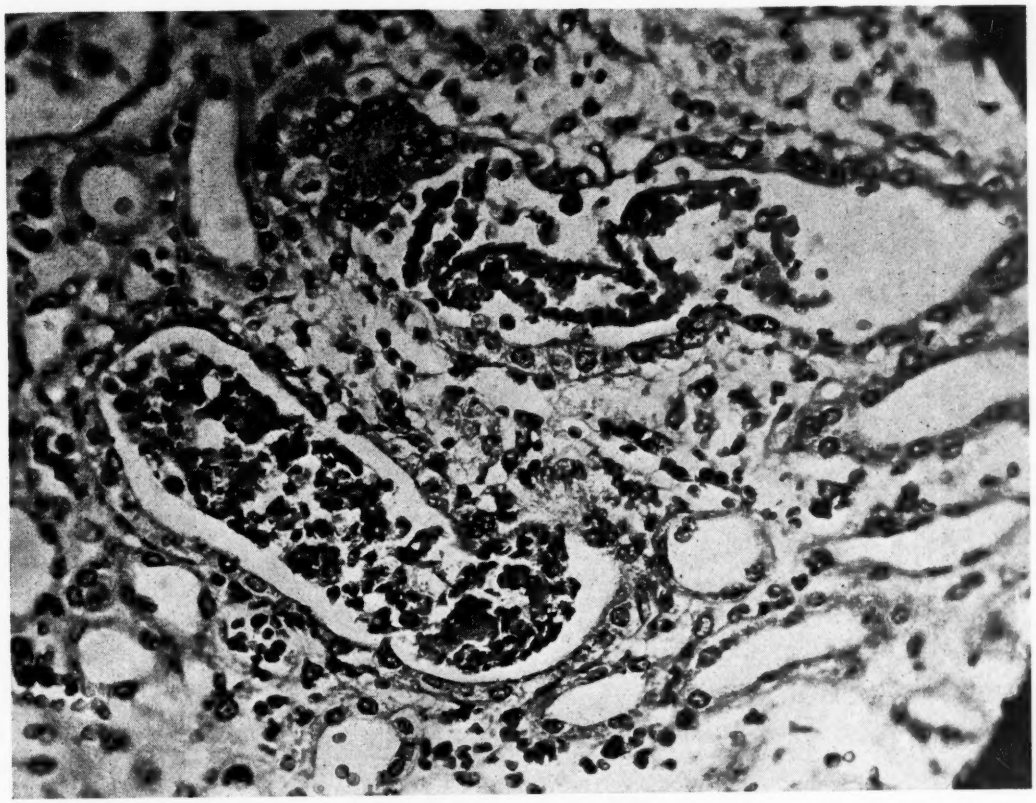

FIG. 1.—Photomicrograph of renal collecting tubules from medulla, stained haematoxylin and eosin, showing, above, ribbon-like pigmented cast, and, below, similar cast invaded by polymorphs and surrounded by desquamated epithelial cells. × 300.

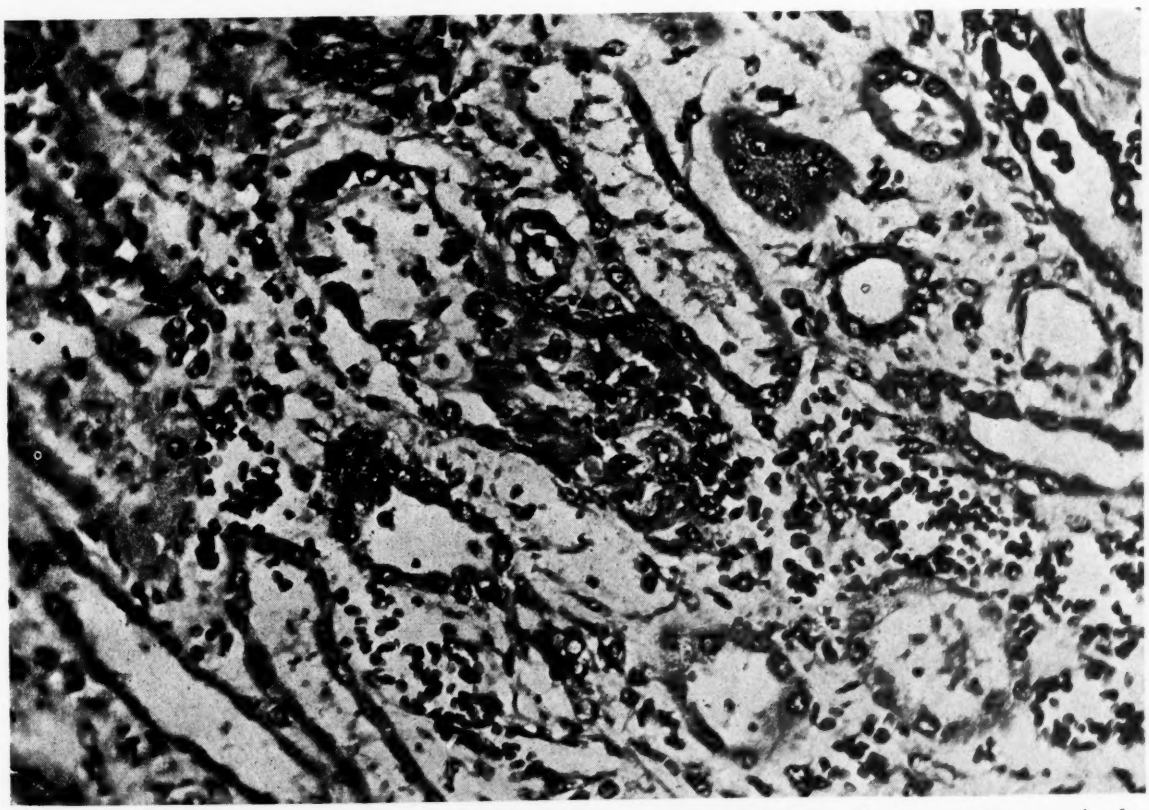

FIG. 2.—Photomicrograph of renal tubule from boundary zone, stained haematoxylin and eosin, showing necrosis of wall and commencing reactive changes. × 280.

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pressure had fallen to 40 mm. Hg; the pulse rate was 108 per minute. Venous blood showed plasma protein to be 9.1 grammes and chlorides (as NaCl) 545 mg. per 100 c.cm. He was given normal saline, and then "serum" intravenously, which, as may be seen from Chart IV, brought the blood pressure to 96 mm. Hg, and the haemoglobin down to 85%; plasma protein was 7.9 grammes and chlorides (as NaCl) 705 mg. per 100 c.cm. This was immediately followed by serum, which effectively lowered the haemoglobin and

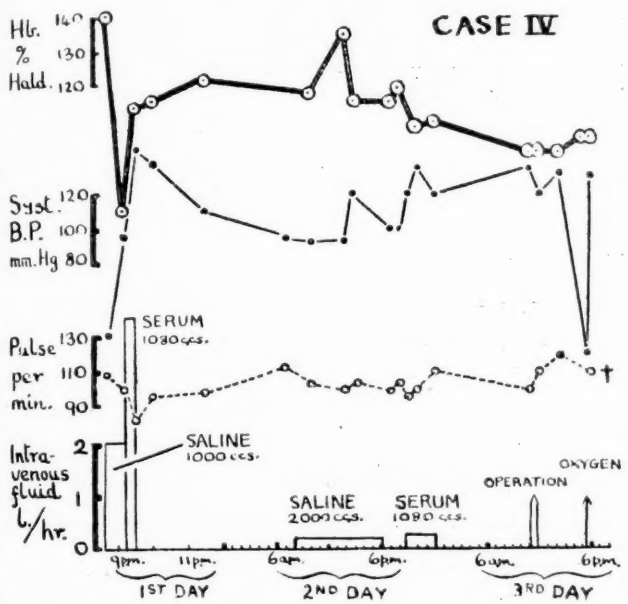

CHART IV.—Case IV (admitted nine hours before the beginning of this chart with a blood pressure of 140 mm. Hg).

raised the blood pressure to a comparatively high level. Next day further serum was given. On the third day the condition of the left foot, which had caused considerable anxiety, was worse: extensive oedema of the thigh had apparently cut off the circulation to the left foot, which was cold and pulseless. Under gas-and-oxygen and ether anaesthesia, incision was made into the left thigh to relieve pressure on the vessels: a feeble pulse was temporarily restored in the posterior tibial artery. Tissue fluid from the thigh contained 1.9 grammes of protein per 100 c.cm. Five hours after the operation the patient suddenly collapsed; although the haemoglobin remained at 105%, the blood pressure fell to 30 mm. Hg. After giving oxygen by B.L.B. mask the pressure rose to 130/82. This restoration of blood pressure was, however, only temporary, and the patient died three hours afterwards. During the last two days there was much vomiting and the abdomen was extremely tense. The urinary output was very low throughout.

Necropsy, by Dr. Keith Simpson, forty-eight hours after death, showed crushed and oedematous muscles of the thigh, with interstitial haemorrhages. There was no bony lesion, no injection, and no gross change in other organs.

On microscopical examination (Dr. Thomas Belt) the muscle showed patchy necrosis, and infiltration with polymorphs. The kidney and other organs were not thus examined.

Discussion

THE RENAL LESION

This consists structurally of severe degenerative changes in the proximal convoluted tubules and, in the more distal part of the nephron, brown pigmented casts of a colour, in unstained preparations, similar to that of blood corpuscles. There are reactive changes round the casts and desquamated epithelium in the medulla (Figs. 1 and 2 on Plate). The matrix of the casts is thought, on histological grounds, to be composed not of red corpuscles but of desquamated epithelial cells. The pigment might therefore be accounted for either by excretion into the lumen from the blood stream of haemoglobin, myohaemoglobin, or bile pigment, or possibly by the extrusion into the lumen of cells already pigmented.

Changes very similar to these are described following mismatched transfusion (Witts, 1929; Goldring and Graef, 1936; Baker, 1937). There is the same absence of changes in glomeruli, and similar changes in the convoluted tubules, in the interstitial tissue, and in the straight tubules. The casts are not composed of red cells, but sometimes there are spherical bodies resembling them. Baird and Dunn (1933) and others have noted similar casts containing "haemoglobin" in eclampsia.

The effect on function of blockage by casts is obscure: if this were the only lesion, what urine was secreted (through unobstructed tubules) should be of normal composition. The urine resembled, however, more a glomerular filtrate; there was no significant concentration of urea (hence no selective absorption of water), and in Case I there was failure to reabsorb chloride when the blood level was below 500 mg. per 100 c.cm. Case II showed some degree of chloride reabsorption. There thus appears to be dysfunction of the convoluted tubules. Whether partial blockage or blockage of a few tubules—cf. the kidney after mismatched transfusion, in multiple myeloma (Forbus *et al.*, 1935; Holman, 1939), and in calcification affecting the pyramids (Albright *et al.*, 1940)—can so raise the intrarenal pressure as to interfere with tubular function as well as with glomerular filtration is not known. It has recently been suggested (Navasquez, 1940) that the degree of tubular blockage is not sufficient to account for the symptoms associated with "transfusion kidney." The hypertension in Cases II and III, and also noted in the case reported elsewhere in this issue (Mayon-White and Solandt, p. 433), may be allied to other types of primary "renal hypertension."

It is possible that minor degrees of this renal damage may occur, since at least one patient with crushed limbs has been observed to recover completely (R. V. Christie, personal communication) with a raised blood urea and low urea clearance. In a similar case of muscle crush seen elsewhere (Beall, Belsey, Bywaters, and Miles, unpublished data) there was a definite tendency towards recovery of renal function, shown by the increasing resorption of both water and chloride. Certain cases of post-operative anuria may prove to fall into this category, but the majority of them appear to be associated mainly with decreased blood volume and blood pressure, since restoration of blood volume to normal improves the renal output.

In Case I fibroblast increase and tubular dilatation were much more prominent than in the other cases. The latter may in part be related to the strong therapeutic stimulation, as caffeine raises the glomerular capillary pressure, with a resultant increase in filtrate (Verney and Winton, 1930).

Aetiology of the Syndrome

Muscle necrosis is the one aetiological factor common to these cases and to those observed elsewhere. It was of limited extent in Case I, although comparison with the degree of necrosis in the other cases is difficult, since the leg was removed thirty-six hours after admission. It would seem of some significance that, in spite of amputation in this case, the time interval between injury and death was of the same order as in the others.

It is known that when muscle is injured its permeability increases and intracellular ions such as potassium leave it rapidly (Horton, 1930). This may be related to the early

increase noted in serum potassium. An evaluation of the relative importance of muscle injury, renal insufficiency, and possibly adrenal cortical deficiency in the composition of this biochemical picture must await the accumulation of further data.

Oliguria in shocked patients may be due to dehydration, sweating, and the fall in blood pressure (since a pressure below 75 mm. Hg is insufficient to produce urine in the absence of circulating diuretic substances—Winton, 1937). The fall in blood pressure lasted for one and one and a half hours only in Cases I and II. Such oliguria certainly facilitates the precipitation of relatively insoluble material in the tubules both in man (e.g., sulphapyridine calculi) and experimentally (e.g., haemoglobin, Yorke and Nauss, 1911). Another possible cause for anuria in air-raid casualties receiving sulphapyridine is the formation of calculi at the uretero-vesical junction (Sadusk *et al.*, 1940). None of these seemed to be of primary significance in the cases cited.

The part played by transfusion fluids (three of these patients received Group O blood as well as plasma and "serum") must be considered, inasmuch as the pathological changes resemble closely those of the "transfusion kidney." There was no evidence clinically of a transfusion reaction, although such can occur in the absence of one or, rarely, all of such symptoms as rigor, chill, backache, and jaundice. Plasma samples taken at seventeen and a half and forty hours after transfusion showed no increased colour. Further, although in Case I, before blood transfusion, haematuria and albuminuria were absent, the high blood urea and low urinary output suggested impairment of renal function. The case reported by Mayon-White and Solandt in this issue (p. 433), and six other cases of which we have heard, received no blood, but plasma or reconstituted serum only. Perhaps, however, the most potent argument against these being due merely to transfusion reactions is that no such condition has occurred in any of 25 shocked and injured patients without severe muscle crush treated in this hospital by blood or "serum" transfusion.

Treatment

The treatment of this condition so far has been by trial and error. It has been directed primarily to restoring urinary output by means of heat to the loins, by saline dilution of plasma protein (thus increasing the glomerular filtering force), by increasing blood volume with serum and hence blood pressure (thus increasing the glomerular capillary pressure), and by the use of diuretics such as caffeine. Decapsulation should perhaps be tried, as it has been shown to reduce the intrarenal pressure (Winton, 1937). In transfusion kidney this has been done twice with successful results (Bancroft, 1925; Younge, 1936).

The effect of adrenal cortical extract in this condition should also be observed, in view of the raised potassium. The development of electrocardiographic changes in Case I was not associated, however, with any significant alteration in serum potassium (cf. Thomson, 1939). In Case II the changes were similar to those seen in many patients a few minutes before death (Wood, personal communication). However, it is unknown whether changes in the heart muscle manifest electrocardiographically were concerned in the striking terminal collapse.

Prevention by early amputation was thought adequate in Case I; it is evident that thirty-six hours was not early enough. Whether there exists an alternative to immediate amputation we shall learn only by further and fuller investigation of such patients and by careful observation of the effects of treatment, or if the condition can be reproduced in the laboratory. Investigations which are designed to induce such a condition experimentally are already in progress at this institution.

Summary

Four cases of crush injury to limbs, producing shock, are described in which after recovery due to replacement of circulatory fluid the patients showed oliguria and pigment casts. They died in about one week with nitrogen retention. Necropsy revealed degenerative changes in the proximal convoluted tubules and pigment casts in the more distal part of the nephron. The aetiology and possible lines of treatment are discussed.

We are grateful to our colleagues engaged on shock research at the British Postgraduate Medical School for their co-operation and participation in this study—in particular to Prof. Dible and Dr. Thomas Belt, and to Dr. J. Clegg, who supplied the serum. Our thanks are also due to the Chief Medical Officer of the London County Council for permission to publish this report.

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A CASE OF CRUSH INJURY WITH RENAL FAILURE

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When a bomb demolished a hostel at 4 a.m. in January a young male leather-worker of 20, of medium height and good physique, was buried beneath the debris and his left leg was crushed against the side of an iron bedstead by a heavy metal girder. Morphine grain 1/4 and hot drinks had been administered and hot bottles applied to the trunk while attempts were made to extricate the man. When he was first seen at 1.30 p.m. the left leg was still trapped, his mental condition was apathetic, the extremities were cold, and no pulse was palpable at the wrists. He was finally released at 2.15 p.m., ten hours and fifteen minutes after the accident.

On admission to St. Thomas's Hospital the blood pressure was 110 mm. Hg systolic and 70 mm. diastolic, and the pulse rate 136 per minute. The haemoglobin concentration, determined by the Haldane method, was 150% (ear). He was pale and lethargic but not cyanosed, and complained of no pain. The left leg was swollen and

tense from six inches below to four inches above the knee-joint. There was no external wound of the limb, the pulsation of the dorsalis pedis and posterior tibial arteries was easily palpable at the ankle, and complete physiological interruption of the peroneal nerve appeared to be present. Physical examination revealed no further injuries. The temperature (mouth) was 97° F. on admission and rose rapidly to 99.6°.

During the first two hours after admission he vomited and his pulse rate tended to rise, while the haemoglobin concentration remained constant. He was therefore given 1,120 c.cm. of stored plasma in a hundred minutes. From this time onward the blood pressure began to rise, reaching 130 systolic and 88 diastolic twenty-four hours after admission, and 155 systolic and 100 diastolic on the third day. In spite of an adequate fluid intake the output of urine dropped from 650 c.cm. on the second day to 205 c.cm., by catheterization, on the third. At this time the patient was drowsy and occasionally vomiting small quantities. A loud systolic murmur was present at the apex, which was three and a half inches out in the fifth space. The left leg was swollen and tense from tip to ankle and showed pitting oedema. The pulse in both the dorsalis pedis and posterior tibial arteries was stronger on the injured than the uninjured side. A catheter specimen of urine was brown in colour, with a large dark brown sediment consisting chiefly of blood-pigment casts. *X*-ray examination disclosed a fracture of the tibia in the middle of the shaft without displacement. Venous blood at this time contained increased urea, potassium, and phosphate (see Table), and an electrocardiogram revealed slurring of the RST segment.

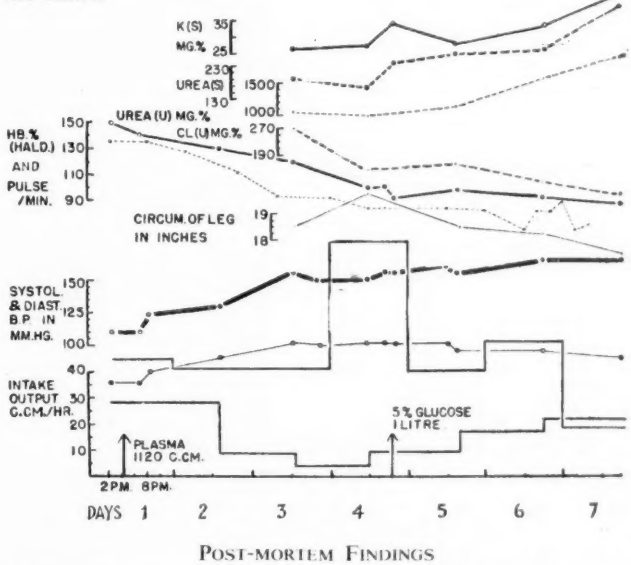
On the fourth day ineffectual vomiting continued. There was now no murmur at the apex. Swelling of the left leg above the knee had increased. The urine was a clear yellow fluid, and microscopically a rare blood-pigment cast was found. The benzidine test was negative. One litre of 5% glucose was given intravenously. After this, on the fifth day, the urinary output was 250 c.cm.; there was no sediment and the benzidine test was negative. The patient was still vomiting, drowsy, and slightly disorientated, but neither anxious nor apprehensive. The left leg had decreased in size. On the sixth day the patient seemed more alert and in good condition. The output of urine increased to 490 c.cm. and only an occasional pigment cast was present. There was less oedema of the thigh, but some pitting oedema had appeared in the right foot. The systolic pressure had risen to 165 mm. Hg and the diastolic had fallen to 95. After the first twenty-four hours the temperature had remained normal.

On the morning of the seventh day the patient complained of lack of fresh air. At 4 p.m., despite slight mental depression, he seemed quite well. At 6.15 p.m. he was still slightly disorientated, but both apprehensive and anxious. The nostrils dilated with inspiration, there were some cyanosis and marked stertor, and rales could be heard all over the chest. The heart rhythm was regular and the apex beat one inch further out. Both lung bases were dull to percussion. The venous pressure was not increased. Soon after the completion of catheterization the patient became intensely alarmed and broke into a profuse generalized sweat. The heart became grossly irregular; the pulse weakened but did not increase in rate. After an injection of morphine grain 1/4 and atropine grain 1/100 the blood pressure returned to 165 systolic and 90 diastolic within ten minutes; the pulse became regular. Thirty minutes after this recovery the patient was again alarmed by a sensation of imminent death; he began to sweat, the systolic blood pressure fell sharply from 155 to 135 and then to 30 mm. Hg; the pulse was irregular and he died in a few seconds.

Day	Serum						Urine					
	Urea mg. per 100 c.cm.	Inorg. P mg. per 100 c.cm.	Chlorides (as NaCl) mg. per 100 c.cm.	Protein gm. per 100 c.cm.	Potassium mg. per 100 c.cm.		Volume c.cm.	Protein mg. per 100 c.cm.	Urea mg. per 100 c.cm.	Chlorides (as NaCl) mg. per 100 c.cm.	Uric Acid mg. per 100 c.cm.	Benzidine Reaction
3rd	188	7.7	480	6.9	26	(2) (3)	205	80	1,050	258	28	Positive
4th	165	7.7	458	—	27	(3)	100	80	1,000	136	21	Negative
5th	235	6.7	525 (4)	6.4	34							
6th	270	6.7	515	6.4	28	(3) (5)	250	70	1,120	156	17	
7th	278	8.7	432	—	34		490	60	1,580	103	16	,,
8th	393	11.1	430	—	43		530	60	1,820	60	14	,,
8th (1)	393	11.1	430	6.5	43	(6)						

(1) At death. (2) Fibrinogen 0.4 gramme. (3) Direct van den Bergh negative, bilirubin 0.8 mg. (4) Received 1,000 c.cm. saline. (5) Calcium 10.6 mg. (6) Uric acid 10 mg. Creatinine 4 mg.

The biochemical findings are recorded in the appended table and are shown graphically, in conjunction with the fluid balance, pulse rate, and blood-pressure readings, in the chart.



POST-MORTEM FINDINGS

Necropsy was performed sixteen hours after death. The macroscopic appearances were as follows: *Kidneys*—Swollen; the cortex was very pale and there were interrupted red streaks in it. The weights of the kidneys were: right 6 oz., left 8 oz. *Heart*—All chambers were full of fluid blood. Otherwise the heart appeared normal. Weight 12 oz. *Aorta*—The aorta was normal except for slight atheromatous change. No thromboses in iliac, femoral, or popliteal vessels. *Muscle*—The muscle in the left leg, in the crushed area, was pale and friable and showed a large number of haemorrhages. The main muscle groups affected were the peroneal group, soleus muscle, and the lower part of the vastus externus. There was a subperiosteal fracture of the left tibia. *Lungs*—Both bases were somewhat collapsed and the upper lobes showed petechial haemorrhages. The left lower lobe was completely collapsed and the bronchi were full of pus. *Liver*—Appeared normal macroscopically, though rather congested. *Spleen*—Small white areas were seen on the surface of the

spleen. These extended about 0.2 centimetre into the substance of the spleen. There was a small amount of perisplenitis on the area in contact with the kidney. *Suprarenals*—No obvious macroscopic change. *Stomach*—Very congested. Appearance of acute gastritis. No definite ulceration. *Pancreas*—Appeared normal. *Intestines*—Normal. *Bladder*—Normal. *Rectum*—Normal. *Thyroid and parathyroid glands*—Normal. *Brain*—There were a number of small (?) cystic spaces in the left posterior cerebrum. These did not appear to have any acute origin. *Pituitary*—Appeared normal. No bony damage to the skull.

HISTOLOGICAL FINDINGS

The following tissues were examined histologically: kidney, lung, liver, spleen, myocardium, pancreas, brain, stomach, voluntary muscle of leg, adrenal, thyroid, and pituitary.

Renal Changes.—The most important changes were those found in the kidneys. In these there were slight oedema of interstitial tissue and changes in the glomeruli and tubules.

The glomeruli: The capsular space was distended by material stained pink with eosin. In the majority of glomeruli this material formed either a net or a net together with a little granular material; in other glomeruli the material was globular, the masses often being about the size of erythrocytes.

Tubules: The majority of the tubules throughout the cortex and in the medulla contained material similar to that found in the glomeruli. In many tubules in both cortex and medulla there were casts of granular brown material, and in some a few clumps of erythrocytes.

In frozen sections no trace of fat was found either in the tubules, cells, or capillaries. These sections did, however, show that the pink material in the tubules and glomeruli filled the spaces more completely than it appeared to do in the paraffin sections. Many stains were tried in an attempt to identify the material in the tubules and glomeruli, but without success apart from a positive stain for fibrin (Weigert's fibrin stain). The material giving a positive stain appeared only in the distal part of the tubules and never in the glomeruli in this kidney. The brown material did not give a positive reaction for free iron.

Other Organs.—Spleen, myocardium, pancreas, adrenal, thyroid, and pituitary were all normal. The lungs contained focal haemorrhages, patches of oedema, and slight acute inflammatory infiltration. The liver showed parenchymatous degeneration and also oedema in the region of the portal systems with dilated lymphatics. In the stomach there were minute haemorrhages in a congested mucosa. In the brain there was a little old and recent haemorrhage in wide perivascular zones in the white matter beneath the cortex in the left temporal lobe. In the voluntary muscles of leg histiocytic reaction was found in the periphery of degenerate partly calcified muscle bundles from the thigh.

Our thanks are due to Mr. W. H. C. Romanis for permission to publish this case.

Although the activities of the National Smoke Abatement Society have had to be limited owing to the war, it has been found possible to continue some of the work and to issue publications, and the financial position is satisfactory. After a meeting held at Manchester the executive committee put forward a comprehensive resolution pointing out that in view of the need to eliminate all forms of waste, attention ought to be directed to the gross and expensive waste causing and caused by the smoke nuisance—a waste not only of fuel and power, and of money, labour, and skill, but of health and amenity; the society viewed with anxiety the deterioration in atmospheric conditions which had occurred during the war. The intensification of the war, however, soon after this resolution was framed, prevented any considerable action upon it or any campaign on the ground of fuel economy against industrial smoke. The president of the society is Dr. H. A. des Vœux, and the British Medical Association is represented on its council by Dr. G. Clark Trotter and Mr. Bishop Harman. The society's eleventh annual report has just been issued.

A CASE OF LIMB COMPRESSION ENDING FATALLY IN URAEMIA

BY

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(From the S.W. London Emergency Blood Supply Depot)

In this issue of the *Journal* (p. 427) Bywaters and Beall report four cases of renal failure in air-raid casualties, three of which received blood transfusion. The pathology of these cases is very similar to that resulting from incompatible blood transfusion. The following case is reported because, though it is clinically similar to and in its essential pathology identical with the cases of Bywaters and Beall, there is the vital difference that blood transfusion played no part in its treatment.

Case Report

A girl aged 11 was pinned under bomb debris for about three hours on a night of October. Members of the rescue party stated that she was lying on her right side, body tilted head downwards at an angle of 45 degrees, the legs acutely flexed at hips and knees. In this position she was compressed, though not actually crushed, by the dead bodies of her parents; a heavy beam lay upon her left thigh.

On admission to hospital she was conscious and rational, as she had been all the time rescue work was proceeding. Though rather pale and complaining of pain in both legs, she seemed comparatively unhurt. Full examination revealed no evidence of injury save some swelling of the left thigh. The blood pressure was not taken, but the pulse was said to be of normal rate and fair tension. During the early morning she passed 4 oz. of smoky red urine which was said to have given a positive result to the tinct. guaiac. test for blood. Radiography showed no evidence of bone injury. The swollen thigh was thought to be due to a deep-seated haematoma from injured muscle.

Next night she was first seen by one of us (O. M. S.). She presented a typical picture of uraemia. She was drowsy and irritable, her skin was dry, her respiration deep and sighing. Her mouth was dry, the tongue covered with brown fur, and the lips cracked. The left thigh was very much swollen, pitting oedema extending from the hip to the toes. The greatest swelling was in the thigh; there was no discoloration of the skin to suggest an underlying haematoma. The left arm was also oedematous. During the next five days the oedema increased and spread till the whole body below the level of the nipples showed pitting on pressure; the swelling was always greater on the left than on the right side. There was no oedema of the face. The patient was nursed throughout in a semi-sitting position, this being the only one she would tolerate. The bladder was never palpable. There was complete anuria save for a few cubic centimetres passed incontinently on the nights of October 30 and 31. Attempts to collect a specimen of urine by catheterization proved the bladder to be empty.

Her condition progressively deteriorated. She became more and more irritable, being much troubled by thirst and later by her inability to move her oedema-bound legs. She was conscious, though increasingly stuporous, until an hour before her death. She died at 4.30 p.m. a week after admission. At no time was the patient jaundiced, nor was there an icteric tinge to the plasma of any blood sample taken for haematocrit readings.

Treatment.—In an endeavour to cause a diuresis 3,000 c.cm. of 5% glucose in normal saline was given by intravenous drip over a period of thirty-six hours from October 29 to 30. In view of the increasing oedema and decreasing plasma

proteins (from 6.4 to 4.8—see table), and since no diuresis had ensued, this was abandoned. Mersalyl 1 c.cm. was injected intramuscularly on October 31, and a similar dose intravenously on November 2.

Table Correlating the Treatment, Blood Pressure, Urine Excretion and Blood Estimations

Date	Blood Pressure	Blood Urea mg. per 100 c.cm.	Hb %	Haematocrit (% R.B.C.)	Plasma Protein gm. per 100 c.cm.	Treatment	Urine Output
Oct. 28	—	—	—	—	—		4 oz.
„ 29	132/100	154	124	54.0	6.4	3,000 c.cm. 5% glucose-saline	Trace
„ 30	125/90	210	94	42.0	4.8		„
„ 31	140/100	295	—	—	—	100 c.cm. 4×N serum	None
Nov. 1 (a.m.)	140/100	295	98	42.5	4.3	400 c.cm. 4×N serum	„
(p.m.)	140/110	309	90	40.0	4.9		
„ 2	150/110	327	88	39.5	4.3		„
„ 3	145/110	369	76	35.5	4.6	200 c.cm. 4×N serum	„

To raise the plasma proteins and because of its diuretic action (Anderson and Boyle, 1940) concentrated human serum was given intravenously. The serum used was the dried serum supplied by the Medical Research Council's serum-drying unit. It should perhaps be emphasized that the serum from Group A (II), B (III), and AB (I) donors is pooled before filtration and drying, and that the effect of this pooling is to render the agglutinin content negligible (Levinson and Cronheim, 1940). A solution of four-times-normal concentration was made. Intravenous injection of 100 c.cm. on October 31, and 400 c.cm. (by intravenous drip) on November 1, produced a rise of plasma protein from 4.3 to 4.9. Coincidently the patient seemed more comfortable. A further infusion was started at 11 a.m. on November 3. 200 c.cm. had been administered by the time she died. (On this last occasion 0.5 gramme of evipan intravenously was necessary to restrain the patient while the cannula was inserted. Anaesthesia lasted twenty minutes. On November 1 sodium amytal grains 1½ by mouth was sufficient.) No reaction was caused by the serum. The patient's temperature remained subnormal throughout her stay in hospital.

Pathology

The post-mortem examination was performed by Dr. J. V. Dacie. The chief findings were as follows:

General: Symmetrical oedema of body from nipples to feet. Arms oedematous below mid-point of humerus.

Thorax: No excess of fluid in pleural cavities. Slight excess of clear fluid in pericardium. Heart normal. Fluid blood in great vessels.

Lungs: Pale and bulky. Slight basal congestion (detached portions floated in water).

Abdomen: Slight excess of peritoneal fluid. Stomach, liver, spleen, and mesentery normal. Considerable injection of the mucous membrane of the bowel from the duodenum to the sigmoid colon. Kidneys large and pale, foetal lobulations well marked. On section the kidney cortex seemed paler than normal. The differentiation between cortex and medulla was very clear. The capsule stripped readily. Ureters normal, bladder empty. No other abnormalities were found.

Thigh muscles: Oedematous but otherwise normal. No extravasation of blood, no microscopical evidence of necrosis.

It is the microscopical appearance of the kidney that is the chief point of interest in this case. Most of the tubules contained a granular debris that stained a brick-red colour with eosin. This material could be found in all parts of the tubule from the capsular space to the duct of Bellini. Proximally it was small in amount and was often embedded in an albuminoid substance, but in the collecting tubules the granules were tightly packed, forming a solid cast of the lumen. At first sight some of these granules seemed to be red blood corpuscles; on closer inspection and comparison with intact corpuscles in the vessels it was evident that the tubular contents were frankly granular, though "ghosts" of broken cells could be seen in some places. In an unstained section the tubular contents were the golden-red colour of unstained red cells. The tubular epithelium in some places showed evidence of degeneration. Some of the cells had lost their outline. There were some pyknotic nuclei. This degeneration seemed to bear no constant relation to the amount of material in the tubule. The glomeruli were normal; the capsular space was not dilated. Special staining showed no fat and no free iron in the kidney substance or in the tubules.

Summary

The case is reported of a patient who died from uraemia following a type of injury that often produces shock. The micropathology resembles that of incompatible transfusion. Unlike similar cases reported in this issue there can be no possibility here of incompatible transfusion, since no blood was given to our patient. Herein lies the importance of this case and the reason for reporting it.

We wish to thank Dr. A. T. Moon for allowing us access to his patient and Dr. J. V. Dacie for performing the necropsy and preparing sections of the kidney and other organs.

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ANTIBODY RESPONSE AND SYSTEMIC REACTIONS AFTER INOCULATION OF A NEW TYPE OF T.A.B.C. VACCINE

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An account was given in last week's issue (p. 391) of the experimental work that led to the preparation of a new type of typhoid vaccine killed and preserved with alcohol. The object of the present paper is to record the results of comparative trials in man, carried out with the new and the old types of vaccine. Observations were made on the local and general reactions produced by the inoculations, and the immunity response was measured by the estimation of the Vi and O antibody content of the sera.

From the experiments described in the preceding paper it seemed justifiable to expect that alcohol-killed and alcohol-preserved vaccines would stimulate Vi antibody response in an outstanding manner and could, by this property, be distinguished from ordinary heat-killed and phenolized vaccines. To test this point, and also to ensure the unbiased reading of the agglutination tests, the first three trials were so arranged that the samples of serum reached one of us (A. F.) labelled only with serial letters and numbers, without indicating which of the vaccines tested had been used for the inoculation of any particular group of volunteers. It will be seen from the following tables that in each of the three trials the group

that had been inoculated with the new type of vaccine could be told from the results of the Vi agglutination tests.

It is generally believed that typhoid-paratyphoid vaccines retain their immunizing potency undiminished for at least a year (Perry, Findlay, and Bensted, 1934) or, according to American workers, even for several years when stored at 8° to 10° C. (Mishulow, Mowry, and Stocker, 1937). In this country the expiry date of batches of T.A.B. vaccine is usually fixed at eighteen months from the date of preparation. There are reasons also for believing that the toxicity of ordinary typhoid-paratyphoid vaccine decreases gradually on storage, so that less severe local and general reactions follow its administration. For the sake of accuracy we considered it necessary to record in the tables the date of preparation of every batch of vaccine that had been employed in the comparative trials. The alcohol-killed T.A.B. and T.A.B.C. vaccines were from the four batches that had been used in the experiments on rabbits described in the preceding paper. Some of the other vaccines were from various sources, but the exact mode of their preparation was known to us, with the exception of one commercial product which is mentioned in Table I.

Antibody Response to Customary Doses of 0.5 and 1 c.cm. of Vaccine

Throughout this investigation each volunteer before receiving the first dose of vaccine had a sample of blood withdrawn from a vein in the arm, and a second sample was taken after the administration of the second dose of vaccine. The sera from the two samples were stored in the cold room without the addition of any preservative and were in each instance examined in parallel for the presence of the various antibodies, using as reagents the same batch of agglutinable suspensions. Any rise in agglutinin titre of 100% or more was taken as "significant" increase in antibody content. The intervals between the two subcutaneous injections and also those between the second injection and the second bleeding varied slightly in the different trials, and are in each case stated separately.

Preliminary Trial

A preliminary trial on a very small scale was first carried out with the kind co-operation of Air Vice-Marshal H. E. Whittingham, Director of Hygiene, Air Ministry. The volunteers were young R.A.F. recruits who had no history of previous enteric infection or inoculation. The two doses of vaccine were given at an interval of ten days, and samples of blood were taken three weeks after the second dose of vaccine. The results of the agglutination tests are summarized in Table I. The H agglutination tests are discussed in a later section.

TABLE I.—*Preliminary Trial of Four Differently Prepared T.A.B. Vaccines in Volunteers among R.A.F. Recruits, May, 1940*

T.A.B. Vaccines				No. Inoculated	No. of Cases showing Significant Rise in O and Vi Agglutinin Titres 21 Days after Second Dose			
Batch	Prepared	Sterilized by	Preserved with		TO	BO	AO	Typhoid Vi
No. 1	February, 1940	Alcohol	Phenol	5	5	5	3	0
No. 2	,,	,,	Alcohol	5	5	5	4	2
No. 3	October, 1939	Heating at 53° C. for 1 hour	Phenol	5	5	5	2	0
Dissolved T.A.B. vaccine	September, 1939	Mode of preparation unknown		5	4	5	2	0

It will be seen from Table I that there was not much difference in the O antibody response stimulated by the four different vaccines. All of them appeared to be quite satisfactory in this respect. On the other hand, the result of the typhoid Vi agglutination test made it possible to pick out the group that had been given the alcohol-killed and alcohol-preserved vaccine, in spite of the fact that very small numbers had been employed in this trial.

With regard to the local and general reactions produced by the various vaccines, Air Vice-Marshal Whittingham had the impression that the heat-killed and phenol-preserved vaccine caused the more severe reactions. There was not much to choose between the three other vaccines. The "dissolved" vaccine was included in the trial because it was known to produce only slight reactions.

Comparative Trial of Three Different Vaccines in Male Mental Patients

The second trial was on a somewhat larger scale. Three groups of male mental patients were inoculated with three different vaccines. The customary doses of 0.5 and 1 c.cm. were given at ten days' interval and samples of blood were withdrawn from the patients three times—namely, before the immunization, on the fourth day after the second dose, and again six days later. The results of the agglutination tests shown in Table II are those obtained with the sera taken on the tenth day after the second injection.

TABLE II.—*Comparative Trial of Three Different Vaccines in Male Mental Patients. August, 1940*

Vaccines				No. Inoculated	No. of Cases showing Significant Rise in O and Vi Agglutinin Titres 10 Days after Second Dose			
Batch	Prepared	Sterilized by	Preserved with		TO	BO	AO	Typhoid Vi
T.A.B. No. 4	May, 1940	Heating at 53° C. for 1 hour	Phenol	21	18	20	7	1
T.A.B.C. No. 1	June, 1940	Heating at 53° C. for 70 min.	,,	22	20	19	12	1
T.A.B. No. 2	February, 1940	Alcohol	Alcohol	22	20	20	13	5

Table II shows that the O antibody response was of much the same order in the three groups. The slightly lower figure for paratyphoid A in the first group may be accounted for by the fact that the corresponding vaccine was made from strains other than those employed in the preparation of the two other vaccines. The only striking difference in antibody response in the three groups was in the typhoid Vi antibody. The number of Vi positive sera in the group immunized with the alcohol-killed vaccine was five times that in each of the two other groups. The two heat-killed and phenol-preserved vaccines had been prepared only a few weeks before they were used in the trial, and the typhoid component that each of them contained was made from a properly selected "full Vi" strain. The T.A.B.C. vaccine No. 1 and the alcohol-killed vaccine T.A.B. No. 2 actually contained the same strain of the typhoid bacillus. There can be little doubt, therefore, that the much better Vi antibody response induced by the alcoholized vaccine was due to its mode of preparation.

In a recent paper Bensted (1940a) described the appearance of significant though transitory Vi agglutinins in the blood of human subjects and of animals that had been inoculated with ordinary heat-killed and phenolized T.A.B. vaccine. The Vi antibody was observed to reach its maximum titre as early as four days after the inoculation and to disappear rapidly in the course of a few days. In view of this observation samples of blood were drawn from the inoculated mental patients on the fourth day after the second dose of vaccine and the sera were examined in parallel with the samples taken, respectively, before the immunization and on the tenth day after the second injection. It is seen from Table II that 7 out of 65 inoculated subjects gave a significant Vi agglutination reaction on the tenth day after the second inoculation. Six of these cases showed the same Vi titre on the fourth and the tenth day after the injection of the second dose, while in one instance the reaction was slightly stronger with the earlier sample. The remaining 58 cases, however, gave negative results with both samples of serum.

Comparative Trial of Four Different T.A.B.C. Vaccines in Volunteers among Naval Recruits

Four groups each of about 60 volunteers were accepted in the third trial (Table III). The course of immunization consisted of the customary doses of 0.5 and 1 c.cm. given at one week's interval, and the second sample of blood was withdrawn fourteen days after the second dose of vaccine. The alcohol-treated vaccines P and A were from the batches that had been used in the experiments in rabbits described in Table II in the preceding paper. The vaccines S and F were prepared at the Royal Naval Medical School, the method of preparation being that at present employed for the T.A.B.C. vaccine now being used for the immunization of personnel in the Royal Navy. Batch F was made with the same strains of typhoid and paratyphoid bacteria that served for the preparation of the alcohol-killed batches P and A. Batch S was made from the cultures employed at the Royal Naval Medical School, except for the paratyphoid B strain, which was identical with that contained in the other three vaccines.

In the preceding paper it was mentioned that the opacity of suspensions of alcohol-killed bacteria is considerably less than that of suspensions killed by heat and preserved with phenol. The opacities of the four vaccines were compared with each other in a Spekker photo-electric absorptiometer which has been calibrated by the R.N. Medical School staff. The following figures were obtained:

Vaccine	Sterilized by	Bacterial Content estimated by Opacity Tests in the Spekker Photo-electric Absorptiometer
S	Heat	2,500 million organisms per c.cm.
F	,,	2,500 ,, ,, ,, ,,
P	Alcohol	1,600 ,, ,, ,, ,,
A	,,	1,400 ,, ,, ,, ,,

For reasons stated in that paper estimation by opacity does not give the correct number of bacteria in suspensions that have been treated in different ways; alcohol-treated suspensions give higher counts as reckoned by opacity alone. It is certain at any rate, from the mode of preparation, that the bacterial content of the two alcohol-killed vaccines was not greater than that of the heat-killed batches.

TABLE III.—*Comparative Trial of Four Different T.A.B.C. Vaccines in Volunteers among Naval Recruits, August, 1940*

T.A.B.C. Vaccines				No. Inoculated	Percentage of Cases showing Significant Rise in O and Vi Agglutinin Titres 14 Days after Second Dose				
Batch	Prepared	Sterilized by	Preserved with		TO	BO	AO	CO	Typhoid Vi
S	June, 1940	Heating at 58° C. for 1½ hours	Phenol	55	78.2	90.9	61.8	66.6	5.4
F	,,	,, ,,	,,	56	83.9	78.5	71.4	50.0	7.1
P	May, 1940	Alcohol	,,	59	84.7	96.6	96.6	59.4	6.7
A	,,	,,	Alcohol	57	84.2	87.7	84.2	44.0	40.3

The results of the agglutination tests are summarized in Table III and need little comment. The O antibody response was equally good in all four groups of volunteers, but the Vi antibody response was about six to seven times greater in the group inoculated with the alcohol-killed and alcohol-preserved vaccine than in any of the other three groups. It is seen from the table that the vaccine P, which was killed with alcohol and preserved with phenol, did not stimulate more of the Vi antibody than the two batches of heat-killed and phenol-preserved vaccine. The range of rise of titres is stated later in this paper.

H Agglutination Tests

The sera from the inoculated persons were also tested for their H agglutinin content, though this antibody need not be considered in assessing the protective value of the vaccines. It was thought possible that the prolonged treatment with alcohol might possibly lead to complete inactivation of the H antigen, so that H agglutinins would not be produced as a result of the inoculation with alcohol-killed vaccines. It is known that the high-titre H agglutinins which are formed after inoculation with ordinary T.A.B. vaccine usually persist in the blood for a very long time and render H agglutination tests useless as a means of diagnosing enteric infection in such inoculated persons. A potent typhoid-paratyphoid vaccine that would not stimulate the unwanted H agglutinins would therefore be a very welcome improvement. It was soon found, however, that each of the batches of alcohol-treated vaccines stimulated H agglutinins in a considerable proportion of the inoculated subjects. Some of the results obtained in the comparative tests in naval recruits are recorded in Table IV.

TABLE IV.—*Showing H Agglutination Results in Volunteers Inoculated with Four Different T.A.B.C. Vaccines*

T.A.B.C. Vaccines			No. Inoculated	No. of Cases giving a Positive H Agglutination Reaction in Dilution 1 in 400 with Suspension of		
Batch	Sterilized by	Preserved with		TH	BH (sp.)	AH
S	Heating at 58° C. for 1½ hours	Phenol	55	42	55	54
F	,, ,,	,,	56	56	55	49
P	Alcohol	,,	59	31	22	16
A	,,	Alcohol	57	7	12	8

The table shows that the men inoculated with the two alcohol-killed vaccines produced much less H agglutinins than those who were given the two batches of heat-killed vaccine. It is also according to expectation that batch A, which was preserved with alcohol, stimulated less H agglutinins than batch P, which was preserved with phenol. It is, however, quite obvious from the results shown in Table IV that H agglutination tests cannot be relied upon for diagnostic purposes even after inoculation with a vaccine that has been killed and preserved with alcohol. Twelve of the 57 men who had received vaccine A gave standard agglutination with one or more of the H suspensions in dilution 1 in 400. In the dilution 1 in 40 the figure was 43 out of 57, and four sera in this group showed H titres of 1 in 5,000. Although hope of success in future attempts need not be abandoned, the position remains in this respect unchanged for the present.

Remarks on the Technique of O Agglutination Tests

It is not generally recognized that the technique of O agglutination tests has not yet been standardized satisfactorily and that the titres recorded by various workers may differ, and in fact do differ, very considerably. This difficulty will probably not be overcome until standard agglutinating sera are employed along with the standard agglutinable suspensions that are at present in use.

The technique of the O agglutination test has changed profoundly since the time when the difference in O and H agglutinin response to T.A.B. inoculation was first described (Felix, 1924). The permanent O variant of the sensitive typhoid strain "901," which is now employed almost universally, had not yet been isolated, and the estimation of typhoid O and H agglutinins had to be done by the use of two typhoid cultures of different O-agglutinability and of a culture of *Bact. enteritidis* Gaertner. The low-titre O agglutinins which appear in the serum after T.A.B. inoculation could not be demonstrated by that insensitive method. The permanent O variants "O 901" (Felix and Olitzki, 1926) and "BO" (strain Glasgow of *S. aertrycke*, Schütze, 1930; Felix, 1930; Gardner and Stubington, 1932) did not come into use until some years later. Gardner (1929) first recommended for the "O titre" the reading of the "last trace of clumping visible with a watchmaker's lens," and this procedure was soon adopted by many workers. It has been pointed out (Felix, 1938) that the dilution which gives the "last trace" reaction is usually ten times higher than that giving the + + + reaction, which had been employed in earlier work on O agglutination in the diagnosis of enteric fever (Felix, 1924).

For the purposes of the present investigation quantities of O suspensions were prepared sufficient for testing all the sera from inoculated human subjects referred to in this paper and also the rabbit sera mentioned in the preceding one. The suspensions were from agar-grown cultures, alcohol-treated and

suspended in buffered formalin–saline solution (Felix and Gardner, 1937). The sensitiveness of the suspensions was in each test checked against standard O agglutinating sera. The serum samples from the naval recruits were tested independently by two of us (S. G. R. and A. F.), using the same batches of suspensions and standard sera and the same technique. Thanks to this precaution the results obtained by the two observers were in good agreement.

The following serum dilutions were tested for O antibodies against the various suspensions:

Bacterial Suspensions	Sample of Serum taken before Inoculation	Sample of Serum taken after Inoculation
Bact. typhosum	1 : 50 1 : 100 1 : 200	1 : 50 1 : 100 1 : 200 1 : 500 1 : 1,000 1 : 2,000
Bact. paratyphosum B		
Bact. paratyphosum A	1 : 25 1 : 50 1 : 100	1 : 25 1 : 50 1 : 100 1 : 200 1 : 500 1 : 1,000
Bact. paratyphosum C		

In order to detect even a very slight increase in O antibody content the titre was assigned to the highest dilution of the serum which showed a "last trace" reaction, visible by means of a magnifying lens. Any difference in titre between the two corresponding samples of serum that amounted to one dilution in the series tested—i.e., an increase of 100%—was taken as "significant." With this very sensitive method of measurement the high figures of "significant" reactions that have been recorded in Tables I, II, and III were obtained.

No attempt was made to express the degree of antibody response in terms of average titres observed in the various groups. It is well known that the ability of different individuals to produce high-titre agglutinins varies over a very wide range. Groups comprising much greater numbers than those tested in these trials would be needed to counteract the effect of individual differences and to produce statistically significant figures. Most of the titres observed with the two sensitive suspensions TO and BO varied from 1 in 100 to 1 in 500, only very few reaching or exceeding a titre of 1 in 1,000. With the less sensitive paratyphoid A and C suspensions the O titres usually varied from 1 in 25 to 1 in 100, and very rarely reached or exceeded 1 in 200.

The readings of the O agglutination tests were taken after two hours' incubation at 37° C., and a further twenty-two hours at room temperature. It was found that O agglutinins of titres as low as those occurring in the serum from inoculated subjects do not withstand prolonged heating at 50° to 52° C., the temperature usually employed for incubating diagnostic agglutination tests. It is known from earlier work (Eisenberg, 1906) that diluting the serum increases the heat resistance of agglutinins, and this is of particular importance in the case of the O agglutinins, which are less resistant to heat than H agglutinins (Felix and Olitzki, 1929). Many of the O reactions recorded in Tables I, II, and III as positive would have been missed had incubation at 50° to 52° C. been employed.

Technique of Typhoid Vi Agglutination Tests

The Vi agglutination tests were carried out with a batch of suspension prepared by Lieut.-Colonel R. F. Bridges at the Standards Laboratory, Oxford, using the sensitive strain Vi I of Bhatnagar (1938). The agglutinability of the suspension was checked against the provisional standard serum which was described in connexion with the standardization of therapeutic anti-typhoid serum (Felix, 1938). It was soon found, however, that the standard of agglutination chosen in that work, and employed also in diagnostic Vi tests to indicate the Vi titre of a serum, was too high for the measurement of Vi antibodies of titres as low as those induced by T.A.B.C. inoculation. A lower standard had therefore to be adopted for the purposes of this investigation. This was chosen at half the original value, so that the standard agglutination which determined the Vi titre was that occurring in the dilution 1 in 1,200 of the provisional standard serum. The degree of this reaction with the suspension that was employed throughout this investigation was a full + reading estimated with the naked eye.

The two corresponding samples of serum taken from each volunteer before and after inoculation were tested against the Vi suspension in the dilutions 1 in 10, 1 in 20, 1 in 40, and 1 in 80, and any increase in titre of 100% or more was considered as "significant." In the series of 227 naval recruits recorded in Table III 34 significant Vi reactions were found. The following titres were observed: 15 had titres of 1 in 10, 11 of 1 in 20, 7 of 1 in 40, and 1 of 1 in 80.

Local and General Reactions

The reactions following the administration of the alcohol-killed and alcohol-preserved vaccine were compared with those produced by the other batches of vaccine employed in the trials. Notes were made separately of the reactions following the first and second doses of vaccine. Records were kept of temperature readings taken during the first two days after the injections and of the occurrence of any of the symptoms that are associated with T.A.B. inoculations. Under local reactions the diameter of erythema and the degree of tenderness were recorded, and special attention was paid to involvement of axillary glands and to any serious complaints of inability to use the arm.

In the course of the three trials described in the preceding sections, and in a few others not hitherto mentioned, about 140 adults were given alcohol-killed and alcohol-preserved vaccine in doses of 0.5 and 1 c.cm. About 100 of the inoculated were men and 40 were women, including 20 nurses. It was soon found that the reactions produced by the new type of vaccine differed in two respects from those caused by ordinary vaccine.

(i) *General Reactions.*—There was a remarkable absence of severe general reactions. Temperatures over 99° F. were recorded in a number of cases within twelve to twenty-four hours, especially among the female volunteers, but the slight malaise was transient and did not cause the nurses to go off duty.

(ii) *Local Reactions.*—The injection is felt as a sting lasting for a fraction of a minute. This is due to the alcohol contained in the vaccine. The early local reactions, consisting of erythema and swelling, were similar to those produced by ordinary T.A.B. vaccine, though they were usually milder and rarely involved the axillary glands. As a rule there was no pronounced muscular stiffness and the arm could be used freely. The inoculated naval ratings, for instance, did not require to be excused duty, which included physical training. The redness and swelling persisted for two or three days and then subsided rapidly, but a small palpable nodule was left in most cases, and this persisted for about ten days before passing off gradually. In some cases the nodule, about the size of a split-pea, could still be felt after three weeks.

In 3 cases out of 140 that were given the customary large doses of vaccine the local reaction has been different—in 1 male and 1 female after the first dose (0.5 c.cm.) and in 1 male after the second dose (1 c.cm.). In these cases there was some local induration, which appeared about the fourth day after the injection and by the sixth day had developed into a small fluctuating area at the site of the injection. This delayed local reaction was not accompanied by any general reaction, did not interfere with the free use of the arm, and disappeared spontaneously in the course of two or three weeks.

The alcohol-killed and alcohol-preserved batches of T.A.B. and T.A.B.C. were the only vaccines that produced the subcutaneous nodule. The vaccine which was killed by alcohol but suspended in saline containing 0.5% phenol (see batch P in Table III) produced both general and local reactions of the type seen after inoculations of ordinary heat-killed vaccine. There can be little doubt, therefore, that the alcohol that is injected with the vaccine is in

some way responsible for the modified reaction. Rabbits inoculated subcutaneously with alcoholized vaccine develop similar nodules. It is possible that histological examination will suggest an explanation of how alcohol and bacterial toxins, when contained in the vaccine, combine to produce the lesion. The absence of more severe general reactions is probably due to the fact that the absorption of toxic substances from the bacterial bodies is delayed as a result of the action of alcohol.

Antibody Response and Severity of General or Local Reactions

Some workers hold the view that the severe reactions that occur after inoculations with ordinary T.A.B. vaccine are of value in enhancing antibody production and thus are not wholly a disadvantage. Ramon's (1926) method of producing artificial sterile abscesses in horses undergoing immunization in order to increase the amount of antitoxin in their blood is sometimes quoted in support of this view. It has been mentioned already that according to Bensted (1940a) ordinary T.A.B. vaccine occasionally stimulates a certain amount of Vi antibody, though it is demonstrable only during a very short period after the inoculation. Bensted found such results solely in men who had suffered from a very severe reaction after receiving a dose of ordinary T.A.B. vaccine.

We have searched very carefully for a possible correlation between Vi antibody response and severity of general or local reactions but have failed to detect any evidence of such correlation. Tables II and III show a few instances of a significant Vi antibody response in subjects inoculated with different batches of heat-killed vaccine. The persons who had these significant Vi titres were, however, not among those who had developed the most severe general or local reactions. The numerous significant Vi reactions that were found amongst the volunteers inoculated with alcoholized vaccine also did not suggest any relation between typhoid Vi antibody and severity of reactions. The same was true with regard to the titres of O antibodies against the four bacterial species tested. Nor was there any constant relation between significant Vi titres and high O titres, or between high O titres for one particular bacterium and those for one or more of the other types.

It seems therefore to be safe to conclude that the severe reactions caused by the ordinary T.A.B. vaccine are not only undesirable, for a variety of quite obvious reasons, but are of no value as a factor contributing to good immunity response. It has been shown in Tables II and III that the alcoholized vaccines, which produced the subcutaneous nodule, were in respect of O antibody formation not superior to any of the other vaccines. It has not yet been established whether the presence of the nodule has any effect on the persistence of demonstrable O or Vi antibodies. This point is now being investigated.

Experiences with Smaller Doses of the New Vaccine

Those who have had personal experience of T.A.B. inoculation of large groups of civilians have long formed the opinion that the doses of 0.5 and 1 c.cm. of vaccine of the usual strength that are employed as standard doses for members of the armed Forces are too large for the less robust average adult civilian. Even half these doses may cause severe reactions, as has been recently stated by Bensted (1940b). Reduced doses of vaccine, carefully graded according to age, sex, body weight, and physical condition, must be employed in the mass inoculation of the civilian population if unduly severe reactions are to be avoided.

Very few data have been published to show the effect on antibody response of reducing the dose of T.A.B. vaccine. Henderson Smith and Brooks (1912) showed that, up to a point, antibody response increased with increase of antigen. More recently Topley (1930) demonstrated in experiments with paratyphoid B bacilli in rabbits that a relatively large increase in the dose of antigen administered resulted in a relatively much smaller increase in the amount of antibody produced. Since, however, these experiments were concerned only with H agglutinins, the results are not necessarily applicable to O or Vi antibody response following administration of T.A.B. vaccine. Our own observations so far consist only of two preliminary trials on small groups, while comparative trials on a larger scale are at present in progress. The results of the preliminary tests, for what they are worth, are illustrated in Tables V and VI.

TABLE V.—*Showing Effect on O and Vi Antibody Response of Reducing the Dose of Vaccine*

T.A.B. Vaccine Batch No. 2 Killed and Preserved with Alcohol			Interval between 1st and 2nd Injections	No. Inoculated	Percentage Frequencies of Significant Increase in Agglutinin Titres 10 Days after Second Dose			
Stored at 1° to 2° C. for	1st Dose (c.cm.)	2nd Dose (c.cm.)	(Days)		TO	BO	AO	Typhoid Vi
6 months	0.5	1	10	22 adult males	90.9	90.9	59.0	22.7
8 ,,	0.25	0.5	14	20 adult females	70.0	75.0	50.0	20.0

The two groups recorded in Table V consisted of adult mental patients. It will be seen from the table that the reduction of the doses to half the amount was followed by a noticeable drop in O antibody response. The low figure for the Vi antibody showed no significant change.

TABLE VI.—*Showing Effect on O and Vi Antibody Response of Reducing the Dose and Prolonging the Interval between the Injections*

T.A.B.C. Vaccine Batch A Killed and Preserved with Alcohol			Interval between 1st and 2nd Injections	No. Inoculated	Percentage Frequencies of Significant Increase in Agglutinin Titres 14 Days after Second Dose			
Stored at 1° to 2° C. for	1st Dose (c.cm.)	2nd Dose (c.cm.)	(Weeks)		TO	BO	AO	Typhoid Vi
3 months	0.5	1	1	57 adult males (naval ratings)	84.2	87.7	84.2	40.3
6 ,,	0.2	0.4	2	19 adult females (nurses)	57.9	57.9	36.8	36.8
6 ,,	0.2	0.4	3	20 adult females (nurses)	90.0	75.0	75.0	35.0

The first group recorded in Table VI is identical with the fourth group shown in Table III, and has been included here for purposes of comparison. The table shows that the reduced doses given at two weeks' interval produced a much lower O antibody response than the full doses at one week's interval. The response was greatly improved by increasing the interval between the injections from two to three weeks. Again there was no significant difference in the figures for the typhoid Vi antibody.

These results seemed to indicate that the doses cannot be reduced drastically without a corresponding decrease in the immunizing effect produced, but that, up to a point, the effect of decreasing dosage can be counterbalanced by increasing the interval between the injections.

So far, reports have been received on the reactions observed in about 250 adult females and 150 adult males who were given reduced doses of the alcoholized T.A.B.C. vaccine. Adult males received 0.25 c.cm. of vaccine

followed by 0.5 c.cm., and adult females had 0.2 c.cm. followed by 0.4 c.cm. Among 210 inoculated nurses only 3 had to go off duty after the first dose of vaccine, none after the second dose. No case of delayed local reaction was observed amongst the 400 subjects who had been inoculated with the reduced dose of vaccine.

Suggested Doses and Recommendations for the Administration of the Alcoholized Vaccine

The alcoholized T.A.B.C. vaccine is equivalent in composition and total bacterial count to the customary vaccine—i.e., it contains 1,000 million *Bact. typhosum* and 500 million each of *Bact. paratyphosum* A, B, and C per c.cm. The following doses of this vaccine are recommended:

	First dose	Second dose
For adult males	0.25 c.cm.	0.5 c.cm.
For adult females	0.2 ,,	0.4 ,,
For children (male or female):		
From 16 to 18 years	0.2 ,,	0.4 ,,
,, 13 to 15 ,,	0.1 ,,	0.2 ,,
,, 9 to 12 ,,	0.05 ,,	0.1 ,,
Under 8 ,,	0.05 ,,	0.05 ,,

These are maximum doses and should not be exceeded: the next smaller dose in the series is advised for subjects in each category who are below average in physical vigour or development.

The interval between the two injections should be three weeks. If this cannot be adhered to and the choice is, say, two weeks or four weeks, it is preferable to choose the longer interval. Revaccination is advisable one year after the primary immunization: a single dose of the size of the first dose mentioned above is sufficient.

General reactions—i.e., languor with slight fever—are as a rule either absent or quite trivial after the small doses of vaccine. If the precaution is taken to make the injections as late as possible in the day—preferably not earlier than six hours before bedtime—any general reaction will go unperceived and only a very small proportion of inoculated subjects will find themselves unfit for work on the following morning.

The local reaction is hardly ever of such a degree as to prevent free use of the arm. This is equally true of the delayed reaction mentioned previously, which was observed in 3 out of 140 subjects who had been given the large dose of vaccine. So far this type of local reaction has not yet been seen in any subject who received the reduced dose of vaccine. It is to be expected, however, that certain persons who are especially susceptible may develop a small fluctuating area even after the injection of a small dose. No treatment of any kind is necessary or advisable for such a local reaction. It is nevertheless emphasized that the quantity of vaccine injected as the second dose must not be increased in these cases. Such susceptible subjects should receive as their second dose only half the quantity of vaccine injected as the first dose.

Summary

A new type of typhoid-paratyphoid vaccine, killed and preserved with alcohol, was compared with ordinary heat-killed T.A.B. or T.A.B.C. vaccine from various sources. Two marked differences were found between groups of subjects inoculated with the two types of vaccine: (1) The alcohol-killed and alcohol-preserved vaccines stimulated demonstrable typhoid Vi antibodies in a relatively high proportion of cases, whereas the Vi antibody response to ordinary vaccines was almost negligible. No significant difference in O antibody response was observed. (2) The reactions produced by the alcoholized vaccine were much milder than those caused by ordinary vaccine. General reactions were as a rule either absent or quite trivial. The local reaction was of a modified type and hardly ever prevented free use of the arm.

No correlation was found between Vi or O antibody response and severity of general or local reactions.

Recommendations are made with regard to the dose of vaccine and the interval between the two injections.

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Clinical Memoranda

An Unusual Injury to the Larynx

The injury in the following case seems to be unusual enough to be worth recording.

Case Report

One night during the black-out a constable, after leaving a brightly lit police station, collided with a pillar-box in the street. The upper edge of this obstruction struck him on the thyroid cartilage. At once he experienced pain in the front of the neck and his voice became husky. The degree of huskiness gradually increased, reaching a maximum four hours after the accident. The next day his voice was still very rough, and there was tenderness to the left of the laryngeal cartilages. An examination of the larynx revealed the presence of a sausage-shaped haemorrhage under the mucosa of the left ventricular band. This haematoma almost completely obscured the view of the left vocal cord, though the extreme edge of this structure became visible when the cords were in full adduction. The possibility of a recurrent laryngeal nerve lesion was eliminated by the fact that both cords moved normally. The condition remained stationary for four days and then gradually improved. On the following day—that is, five days from the infliction of the injury—the voice still sounded deeper than usual. The haematoma was much decreased in size and the ventricular band looked purplish and swollen, but the vocal cord was clearly visible. It took twelve days for the voice to become quite normal, and in eighteen days all signs of the injury had disappeared.

Commentary.—Fatal and non-fatal cases involving injury to the neck are relatively common in police work. This particular case seems to emphasize the necessity for examining the interior of the air passages in all non-fatal medico-legal cases involving injury to the neck. Very often the assaulted person complains of pain and tenderness near or over the larynx, but apart from the tenderness that can be discovered externally there may be no concrete clinical findings that will serve as indisputable proof of injury received. Marks of finger-nails and bruising may be found externally; but this is not invariable, and the bruising may take several days to appear on the surface. In all such cases, therefore, a laryngeal examination might prove valuable.

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An Advanced Case of Cerebrospinal Fever

Remarkable recoveries from cerebrospinal fever are often observed with modern methods of treatment. The following account of a case of unusual severity may be of interest because the patient was completely restored to health although he had been moribund and paralysed for a considerable period.

CASE HISTORY

On May 28, 1940, an Italian café proprietor aged 42 was admitted to hospital. For ten days before admission he had a severe headache, with pyrexia on the third day, and for two days before admission he was comatose.

On admission the patient obviously was desperately ill. The respirations were Cheyne-Stokes in character, the rate being 28. There was no fever. Pronounced neck retraction and a right-sided hemiplegia were present. Lumbar puncture showed the cerebrospinal fluid pressure to be 260 mm., and 20 c.cm. of thinly turbid fluid was withdrawn from which meningococci were cultivated.

Sulphapyridine was given immediately. The dosage is shown in the accompanying table. After twelve hours the

Table of Treatment

Day	Sulphapyridine gm.	Serum c.cm.	C.S.F. Pressure	Vitamin B_1 mg.	Condition
0			260 t.		Bad
1	9	25 B. & W.	260 f.		
2	8	25 "	260 t.		
3	8	30 M. "			
4	6	30 "		10	
5	6	30 "	150 c.	10	
6	4	30 "		10	Critical
7	4	30 "	150 c.	10	
8	6	30 "		10	
9	6	30 "		10	
10	6	30 "		10	
11*	6	30 "		10	
12	3	30 "		10	Improvement
13	3			10	
14				10	

B. & W.=Burroughs and Wellcome. M.=Mulford. t.=turbid. f.=flocculent. c.=clear. * Blood transfusion.

patient was even worse, and a further lumbar puncture was performed. The pressure was again 260 mm., and 10 c.cm. of fluid was removed; this time it was flocculent. Fluids were administered intravenously, as the man was very dehydrated and it was considered that this fact might be contributing to his grave condition. On May 29 daily intramuscular injections of anti-meningococcal serum were begun, being continued for the next eleven days. Vitamin B_1 was injected daily in doses of 10 mg. for about three weeks, when the dose was diminished to 2 mg.; this treatment was continued until full recovery occurred. The frequency with which lumbar puncture was performed is shown in the table. On the fifth day after admission the cerebrospinal fluid pressure was approximately normal and the fluid was clear.

By the end of the first week of his stay in hospital the patient showed no sign of return of consciousness and the respirations were still grouped; a few days later he developed bronchopneumonia. During the second week, while the temperature, pulse, and respirations were still raised on account of the chest condition, indications of improvement were observed; at times during the day he would take notice of what was going on around him. It was considered that recovery might be encouraged if he were given a blood transfusion. Accordingly 500 c.cm. of fresh blood was administered, following which daily improvement was observed. Some days before he began to talk his sense of humour returned. He now became aware of his incontinence, and this was the first step towards its control; then the plantar response on the right side became flexor and the leg showed signs of returning function. The hand was the first part of the upper limb to manifest improvement, and a week later the shoulder muscles, encouraged by massage, followed suit. After six weeks he could walk with help and sign his name with a rather childish hand. When last heard of he was completely restored to his normal health.

I am indebted to Drs. A. C. Hampson and W. S. Hunt for permission to publish this case.

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Pulmonary Tuberculosis in Soldiers

The admission of men with pulmonary tuberculosis to the Army is of extreme importance from both the economic and the hygienic points of view, and therefore analysis of the data from the first 100 cases personally examined and "boarded" out of the Army may be of interest, especially in regard to evidence of disease previous to entry and likely factors in causing promotion or exacerbation of symptoms.

The age incidence in this series was: 9 patients under 20 years, 78 from 20 to 30, 9 from 30 to 40, and 4 over 40. Of these, 22 gave a history of active pulmonary tuberculosis in members of the immediate family circle—mother, father, brother, sister, or wife.

There was clear evidence that 18% had been in sanatoria and 15% more were suffering from the disease previous to admission to the Army. In 41% the condition was manifest within a month of recruitment, another 11% within three months, 16% in six months, 16% within a year, and only 16% first showed symptoms after a year. The value of medical supervision and weight recording in the first three months of Army life is therefore obvious. Cooper (1940) says that 5% of recruits to the 6th Division of the A.I.F. were turned down by medical boards on account of phthisis and that another 0.9% were later discovered by microradiography, of which over half appeared to be active. These figures bear out the importance of the recommendations of the Committee of the Ministry of Labour and National Service (1940), presided over by Lord Horder, that (1) medical boards should obtain from recruits a signed statement that to their knowledge they have never suffered from pulmonary tuberculosis; and (2) that district medical officers of health should (*a*) furnish all men likely to be called up, and known to be suffering from phthisis, with a certificate to that effect, and (*b*) notify the Ministry of Health of this fact, so that medical recruiting boards might have this information before them.

Analysis of the clinical records of the 100 cases shows that 15 had a definite past history of pleurisy and that in 22 the onset of the condition was made manifest by an attack of pleurisy. In 27 haemoptysis was the first symptom, in 29 cough, in 16 general symptoms of lassitude, loss of weight, etc.; in 7 the onset was acute and was first mistaken for pneumonia, and in 3 the main symptoms were gastric, the cases being sent up to the medical specialist clinic as suffering from peptic ulcer. In addition 1 came under attention with tuberculide, 1 with ischio-rectal abscess, and 1 was diagnosed when admitted for acute appendicitis. When medically "boarded" out of the Army 42 of the men had bilateral and 41 unilateral infection, the right lung being affected slightly more often than the left. In 48 of 78 cases the sedimentation rate was definitely increased, and in only 2 cases in which the sputum was loaded with tubercle bacilli was the sedimentation rate under 10 mm. Westergren at the end of one hour.

Factors in causation suggested by the men were: prolonged exposure to severe weather and damp, 32; heavy work and lack of sleep, 32; poor ventilation due to black-out and housing difficulties, 14; and difficulty in obtaining adequate food (in Belgium), 10. 31 of the men could find no exception to any condition under which they had had to work.

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Major, R.A.M.C.

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Cooper, E. L. (1940). Ibid., **2**, 246.

Reviews

BOVINE TUBERCULOSIS

Man's Greatest Victory over Tuberculosis. By J. Arthur Myers, Ph.D., M.D., F.A.C.P. (Pp. 419; illustrated. $5.00 post paid or £1 7s. 6d.) Baltimore: Charles C. Thomas; London: Baillière, Tindall and Cox. 1941.

A wealth of medical and scientific knowledge has been assembled to prevent, diagnose, and treat tuberculosis. The disease is no longer solely one of medical significance and relegated entirely to the physician and surgeon. Its social and economic implications are far-reaching, and the anti-tuberculosis worker, whether he be administrator or clinician, throws his net widely and seeks aid from many quarters to combat the disease.

It is well known that a certain proportion of human tuberculosis, especially that of children, is caused by bovine tubercle bacilli, and that human beings may be infected through the ingestion of tuberculous milk or tuberculous meat. It has been estimated that not less than 40% of all the cows giving milk in England are infected with tuberculosis, so that there is every possibility of bovine infection. The proportion of cows actually yielding tuberculous milk is still probably between 1% and 2%. It is here that the veterinarian steps in to contribute his wide knowledge of tuberculosis in cattle towards preventing the disease in man. The link between medicine and veterinary medicine is an important one and mutually beneficial. This was a lesson that Sir William Osler was never tired of preaching, and he put his words into practice, for he had a teaching post at a veterinary college in his younger days, and made notable contributions to comparative pathology—for example, by his investigation of hog cholera. Sir Clifford Allbutt, also, realized the importance of epizootic disease in its relations to man, and was largely responsible for instituting a section of comparative pathology in the Royal Society of Medicine.

In tackling the problem of bovine tuberculosis the United States has obtained great success. This book by Prof. J. A. Myers of the University of Minnesota tells the story of the struggle and the triumph. The earlier chapters deal with the dependence of mankind upon domestic animals, particularly cattle, the development and progress of veterinary practice, and its value in solving important economic and public health problems. The prevention, diagnosis, and treatment of tuberculosis in cattle are discussed.

In the diagnosis of bovine tuberculosis main reliance is placed on the intradermal or intracutaneous tuberculin test. It is curious that the author makes no reference to the prolonged and careful work of the Tuberculin Committee of the Medical Research Council on this test, which is embodied in two reports, published in 1925 and 1928, or to the double intradermal method which the committee advocated. As regards the immunization of cattle against tuberculosis, Prof. Myers rules this question out of practical politics. He writes (p. 196): "Although B.C.G. and all other proposed methods of immunizing cattle against tuberculosis have been given adequate trial in North America they were found wanting and were completely discarded by the veterinary profession." So sweeping a conclusion would hardly receive general scientific acceptance, for a good deal of research work on this problem was done in this country up to the war by Buxton, Stanley Griffith, and others.

Prof. Myers gives details of the work done in the various States of the Union. He records with justifiable pride American achievement in eradicating reactors from tuberculous herds and in the building up of clean herds. Such achievement is equally possible in this country, but, as was the case at first in America, the question of expense has frightened stock-owners, although Jordan's work for the Medical Research Council has shown that good results can be secured in heavily infected herds at small cost. Prof. Myers notes that by eradication methods from 1917 to 1939 inclusive the incidence of reactors in tested areas decreased from 3.2% to 0.5%. This reduction must undoubtedly diminish the sources of bovine infection in human beings. At the same time a good deal of credit is due to the pasteurization of milk supplies, which is much more extensively done in the United States than in this country.

The final chapter of the book is entitled "Lessons for Physicians in Human Medicine." Here Prof. Myers claims that veterinarians are in advance of the medical profession. He holds that contagious tuberculosis is primarily a disease of adult life, that brief exposure to infection is dangerous, and advocates a much stricter segregation of tuberculous patients, to be enforced if necessary by legislative action.

All will not agree with Prof. Myers's conclusions, but his book is a mine of information on its subject and stimulates thought. The chief reflection it inspires is that the United States is far ahead of this country in dealing with the problem of bovine tuberculosis. This is not the fault of the British medical and veterinary professions, but because public opinion still fails to realize that much disease and suffering are brought about by drinking tuberculous milk, and legislation waits on public opinion.

WAR AND CRIME

War and Crime. By Dr. Hermann Mannheim. (Pp. 208. 10s. 6d. net.) London: Watts and Co. 1941.

A discussion of the influence of war upon crime can never depart very far from a consideration of the relationship between war and crime in general. It certainly seems as though a diminution in crime among "civilized" States ran with an increase in the ferocity of their wars. Dr. Mannheim's book indicates a great many attractive lines of thought which start from this central fact of the common factor between crime and war. He clarifies, first of all, two essential points of contrast: crime is an individual action, war a group action; crime is always a wrong, war is wrong only according to circumstances. He then inquires how far the various factors likely to produce crime may also be held responsible for the causation of war, and vice versa; and the further question of how far war itself causes crime. His final section deals with the attitude of international law as it exists to-day towards the distinction between just and unjust wars, and with analogies between war aims and aims of punishment.

Dr. Mannheim concludes that if the conception of war is restricted to unjust war, the difference between war and crime dwindles away almost to nothing. There exists accordingly a strong affinity between the causes of war and those of crime, and the methods which have been suggested for securing peace and for overcoming crime are, he points out, in many ways identical. They include institutional and social improvements, and, probably more important, psychological remedies which in their various ways canalize and deflect the aggressive spirit. In considering the influence of war on crime, he finds at first sight a contradiction. He believes, and gives plenty of evidence for the belief, that war is a potent source of crime and invariably increases the crime rate. On the other hand, he sees indications that war is sometimes a substitute for crime. At many points he finds the proba-

bility that war and crime may in some way be subject to the principle of indestructibility of matter: if either evil is discouraged in one form it may show itself in the other. Serious crimes of violence may decline owing to the competition of war as a more impressive form of violence, and they might increase if war were completely suppressed. Economic crimes, however, he finds, invariably thrive during and after wars.

His reasoning on the aspect of war as an international crime has intimate application to the present day. The dilemma with which he is confronted is that on the one hand it is vital for the upholding of decent standards of national and international morality that criminal responsibility should be extended to corporations and nations; on the other hand, criminal responsibility cannot be separated from the idea of guilt. This world is not one in which each individual can be the sole master of his acts, and so it seems hardly unfair to hold the entire community responsible for collective misdeeds which are only made possible by the support which the leader receives from the majority of the members.

This work, faithfully documented and factual as Dr. Mannheim's work always is, forms a substantial contribution to present-day sociological thought.

RADIOLOGY OF DIGESTIVE DISEASES

Clinical Roentgenology of the Alimentary Tract. By Jacob Buckstein, M.D. (Pp. 652; 525 illustrations. 50s. net.) Philadelphia and London: W. B. Saunders Company. 1940.

Recent books on *x*-ray work either deal elaborately with the technique and details of interpretation of radiographs or present a series of pictures in the form of an atlas of reference. Dr. Buckstein's volume is almost a textbook of diseases of the digestive tract written from the point of view of the radiologist. Full descriptions are given of the normal and pathological *x*-ray appearances of the whole of the alimentary canal with short notes of illustrative cases. The author treats the subject not as a specialist but as a physician who can take and interpret *x*-ray pictures, and he has made his book so readable and accurate that it may be recommended to a large public. The usual and well-known characteristics of gastric and duodenal ulcer, cancer of stomach and colon, and diverticula and ulceration of the colon are here well described; while the author's sound judgment is illustrated in his description of the care needed in assessing the progress of gastric ulcer by the amount of healing and size at the same exposure, especially the character of the edges and rigidity of the surrounding stomach wall, in the sections on the diagnosis of appendicitis, on enteroptosis and the relation of constipation and spastic colon.

This book is comprehensive enough to be of value to radiologists and students of radiology, and to the clinician it offers many admirable features. There is a useful bibliography and the illustrations are well produced.

DISEASES OF URETHRA AND PENIS

Diseases of the Urethra and Penis. By E. D'Arcy McCrea, M.D., M.Ch., F.R.C.S.I., F.R.C.S. (Pp. 306. 21s. net.) Bristol: John Wright and Sons, Ltd.; London: Simpkin Marshall, Ltd. 1940.

The publication of this book is a welcome sign of the vitality of medicine in this country even under wartime conditions. The author (whose recent death by enemy action will be in the minds of many readers) has produced a monograph on diseases of the urethra and penis which contains a wealth of material for the urologist and the general surgeon, and as such is a valuable book for the specialist. The general arrangement of the work is excellent, it is written throughout with clarity and lucidity, and it might well serve as a guide to many medical writers. The printing and the high standard of the many illustrations and drawings are of the quality which is associated with Messrs. John Wright and Sons of Bristol.

The book opens with very good accounts of the anatomy, developmental anomalies, and congenital malformations of the urethra and penis. The illustrations in these sections and in that dealing with epispadias and hypospadias are particularly valuable in elucidating the text. There is a full account of acute and chronic urethritis, their complications and treatment. The subject of urethral stricture is amply covered, its treatment well described, and the various operative procedures clearly illustrated. The various types of peri-urethritis due to extravasation of urine and acute infection, the chronic indurative type, and the rarer types due to tuberculosis, syphilis, etc., are all described in detail. Other sections of the book cover calculus and fistula of the urethra, tumours of the urethra and penis, and injuries and inflammations of the penis. Medicine and surgery in this country often have to carry on in the face of the most serious material and physical difficulties, and in this respect the Manchester urologists have had their share of difficulties. It is therefore all the more pleasurable to welcome a urological monograph of such high standard and critical outlook in wartime, but this feeling is tinged by sadness at the untimely death of the author.

Notes on Books

Electrocardiography, by Drs. C. MAHER and P. H. WOSIKA, is an elementary book intended as an introduction to the subject. The normal and the chief types of abnormal curves are illustrated by means of 100 tracings, and accompanying each are an analysis and interpretation. The figures are adequate but not first class, and the heavy time lines and horizontal 1 mm. lines impair their clearness, while the absence of any lettering on the waves makes the student's task more difficult. In one or two instances there are inaccuracies in the descriptions of the tracings, and the section on coronary disease lacks a good illustration of RS–T deviation in acute cardiac infarction. As a whole, however, this book well meets the requirements of the beginner. The third edition is published in Baltimore by the Williams and Wilkins Company, and in London by Baillière, Tindall and Cox at 22s.

Dr. DAVID FERRIMAN has written a useful monograph on *Acrocephaly and Acrocephalosyndactyly* (Oxford University Press, 10s. 6d.). It is based upon his own observations of eighteen cases of acrocephaly and an extensive investigation of the literature. The particular value of this monograph lies in the author's painstaking efforts to sort some order out of a complicated nomenclature—he asserts, for example, that Crouzon's disease (cranio-facial dysostosis) and acrocephaly are one and the same disease—and also in his insistence that treatment of a surgical nature to prevent optic atrophy must be undertaken early, certainly before the age of 5 years and probably better in the first or second year of life. Dr. Ferriman's evidence clearly points to familial transmission of the disorder almost certainly as a dominant, since one of the families investigated by him showed unquestionable evidence of the disease in three consecutive generations.

The *Dentists Register* for 1941 has now been published for the Dental Board of the United Kingdom by Constable and Co., price 12s., post free 12s. 9d. The total number of names appearing on January 1 of this year is 15,032, being twenty-two more than the figure for 1940. All the new entries added during the year were of persons registered as graduates or licentiates, and 1940 was thus the first in which no persons were registered without qualifications under the provisions of the Dentists Act, 1921–3.

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VACCINATION AGAINST TYPHOID

It may not be generally known that the method of making T.A.B. vaccine has passed through several stages of development during the last ten years. The antigenic analysis of the typhoid bacillus on which these developments are based has been largely the work of Dr. A. Felix, whose paper in our last issue (p. 391) described a further stage in the refinement of this product and the theoretical basis on which it rests. With S. G. Rainsford and E. Joan Stokes he reports in this issue (p. 434) the results of practical trials of the new vaccine, and makes recommendations about the method of its use. The difference between this vaccine and its predecessors is that in a considerable proportion of individuals it stimulates the production of Vi agglutinin, an antibody which hitherto has only been known to be produced in man by actual infection. That this antibody is important is self-evident from this fact alone; other evidence of its value involves a consideration of the various methods of estimating the immunizing power of a vaccine experimentally. One of these is the active immunization test in mice, in which administration of the vaccine is followed by inoculation with varying doses of living bacilli. This test, which has been extensively employed for some years, discloses no differences in immunizing power between vaccines killed and preserved in various ways, some of which are known to destroy the Vi antigen. Passive protection tests, on the other hand, tell a different story: the vaccine is here used to immunize a rabbit or other animal, and the protective power of this animal's serum is then estimated by administration to mice together with lethal doses of typhoid bacilli; this power has been shown to depend on its Vi antibody content. This antibody is also considered to be the most important element in the new therapeutic anti-typhoid serum.

There is therefore evidence from three directions that a vaccine which stimulates Vi antibody formation will immunize better than one which does not. The next question is how to prepare a vaccine which will do this. Experience with horses used in the preparation of anti-typhoid serum shows that heat-killed vaccines have not this effect; formalinized vaccines have, but the Vi antibody formed is functionally deficient, as indicated by the results of passive protection tests in mice and the study of phagocytosis-promoting property. The only type of killed bacterial suspension found to stimulate the production of efficient Vi antibody is one treated with alcohol. The two present papers record a study of the effects of such a vaccine in the human subject. It was first shown that an alcohol-killed vaccine, made of course from virulent cultures containing adequate Vi as well as O antigen, does in fact stimulate the production of Vi antibody in a substantial proportion of immunized individuals, although by no means in all. This property, however, was lost on preservation with phenol or tricresol. Tests were therefore made with a vaccine not only killed with alcohol but preserved in it, the respective concentrations used being 75% and 25%. With this method of preservation, which is fully efficient for averting contamination, the capacity for stimulating Vi antibody formation is retained for nine months at least. Such a vaccine causes the formation of as much O antibody as an ordinary heat-killed vaccine preserved with phenol. Since alcohol destroys flagella, an alcohol-killed vaccine naturally produces less H agglutinin; it was hoped that it might produce none, since this antibody has now been degraded to the status of a mere source of confusion in interpreting diagnostic agglutination tests, but the quantity formed is sometimes such that this difficulty still exists. Alcohol-treated vaccine causes less severe reactions than the old type of vaccine—a secondary but nevertheless important point in its favour. Those who are accustomed to regard severe reactions as an accompaniment of more efficient immunization may at first sight be suspicious of this, but a study has been made in the course of this work of the possible relation between degree of reaction and extent of antibody response, and no such relation has been found. A further study of the effect of different doses on antibody response suggests that the usual doses may safely be somewhat reduced, and a longer interval between them is advised.

Presumably this vaccine will shortly be issued in place of the old type of vaccine, which has been extensively used recently, and indeed is still in use, in areas and among persons possibly exposed to an unusual risk of enteric fever. It may be long before any conclusive evidence of its protective power is obtained in the form of data on the incidence of the disease in vaccinated subjects. It is one of the major misfortunes of immunology that the typhoid bacillus should not be pathogenic for any animal in the manner in which it is for man; really appropriate tests of immunizing procedures are therefore not possible in animals. The disease itself has usually so low an incidence that for any significant test in man the numbers employed must be very large. Thus, although anti-typhoid vaccine has perhaps as sound a theoretical claim as any bacterial vaccine to be considered effective, and has certainly been more used than any other, practical proof of its efficacy is difficult to obtain. It is a somewhat disturbing thought that such proof as we have relates mainly to immunization with vaccines prepared without any regard to the nature of their antigenic content, and certainly lacking the distinctive property of the new material. In the action of the new vaccine itself there is one disappointing feature—namely, that it by no means always elicits Vi antibody production when given to human subjects in customary doses, but only in a proportion which is sometimes about one-half and sometimes less. It is possible that the method of preparation may be improved still further, and in the meanwhile all the evidence obtainable by laboratory methods indicates that progress is being made in the right direction.

CRUSH INJURY AND KIDNEY FUNCTION

Wars have a habit of throwing up new medical problems or putting old problems in a new perspective. The cases reported in this issue of fatal renal failure after burial under debris may fall into either category. In the typical case the patient has been pinned by the limbs under fallen masonry and released usually after many hours. There may be no fracture and no external wound except superficial abrasions only. These abrasions become whealed and the limb swells, while at the same time plasma constituents are lost, the haemoglobin concentration rises, and the blood pressure falls. This stage of "shock" is satisfactorily treated by transfusion of serum or of plasma. It is then found that the urinary output is falling off, often with blood casts in the scanty urine. Vomiting becomes persistent, the blood urea rises, and many patients die in the course of a few days with renal failure as the predominant manifestation.

These initial communications are concerned more with a description of the clinical, biochemical, and pathological manifestations than with any attempt to explain the underlying mechanism. Although the pathological appearances in the kidney bear a resemblance to the transfusion kidney, transfusion of incompatible blood may be excluded as a cause. The diminution of urinary output after operations has usually been ascribed to low blood pressure, but hypotension seems to have been promptly treated and transient in those crushed patients whose records are adequate. A characteristic finding appears to be the rise of serum potassium, which cannot be ascribed to the renal damage. The workers at the British Postgraduate Medical School regard muscle injury as the most significant feature in the "crush syndrome," although histological evidence of this was rather scanty in one of their cases, while Mayon-White and Solandt failed to find any. None the less, "biochemical" damage may exist without there being any gross histological manifestations, and the mass of muscle which may be involved precludes full histological examination. Oedema of the crushed area and haemoconcentration have been fairly constant events, and it is also of interest to note that the blood pressure has been high in many of the patients after the initial shock.

The publication of these case records is timely for many reasons, apart from the immediate urgency of the problems they raise. First, crush injuries to limbs may prove to be common during the course of the war, and the collected material is a useful basis on which to build up further observations on the clinical course. Secondly, attention is drawn to the importance of more careful study of kidney function in trauma of all types. It is probable that the extreme and fatal picture presented by eleven out of the sixteen cases represents one end of a scale in which there may be all gradations. Thirdly, the subject is of great interest and significance in relation to general problems of extrarenal azotaemia and renal disease. The attempts made to explain the rising blood urea of hypochloraemia, gastro-intestinal bleeding, Addison's disease, diabetic acidosis, etc., have usually invoked the idea of lowered blood volume and diminished renal blood flow. It is possible that in these cases of crush injury some other factor is operating—perhaps autolytic products liberated in dead or dying tissues. In this connexion the resemblance to the toxaemic state commonly found in concealed accidental haemorrhage in pregnancy is worthy of note. In the majority of instances the toxaemia conforms to the characteristic eclamptic picture, but, in some, suppression of urine and a rapidly rising blood urea are followed within a short time by death from renal failure. In such cases it has been shown that a large area of the detached portion of the placenta has undergone necrosis while still incorporated with the remaining placenta and its circulation.[1] There are also resemblances to the toxaemia of severe burns, in which similar biochemical changes occur in the blood.[2]

The observations that have so far been made point to the need for amplification and clarification by animal experiment, and in view of the urgency of the problem we hope that such work will be pursued with an energy appropriate to the times. On the therapeutic side there are as yet few clear guiding lines as to what should be done. In at least one instance fairly early amputation of the affected limb failed to save life, while in others recovery occurred without amputation. It therefore cannot be said that crushing is in itself an indication for removal of the limb. There is a case for the trial of suprarenal cortical hormone with careful biochemical control, although it should be noted that the suprarenals showed little change at necropsy. The situation may be clarified by further and perhaps earlier studies. It is important that crushed casualties should be admitted whenever possible to hospitals where there are facilities for full investigation. Minor crushes are of great importance, and necropsies should be performed on those patients who die soon after release. When such studies have been made, together with control observations in other types of injury and with careful animal work, we shall be nearer an understanding of this new medical problem.

[1] Young, J. *J. Obst. Gyn. Brit. Emp.*, 1914, **26**, 1.
[2] Wilson, W. C., MacGregor, A. R., and Stewart, C. P. *Brit. J. Surg.*, 1938, **25**, 826.

TUBERCULOSIS IN WARTIME

Tuberculosis has attracted much attention since the outbreak of hostilities. There are three reasons for this. First, when war was declared tuberculous patients were discharged wholesale from institutions, without any arrangements having been made for their alternative treatment and care. Secondly, there is the fear that the well-known effect of the war of 1914–18 on the incidence of tuberculosis may be repeated to-day. And, thirdly, it is increasingly realized that men with unsuspected pulmonary tuberculosis that could be detected by mass radiological examination have been admitted into the Services. In a supplement to the August–September issue of *Tubercle*, E. L. Collis examines statistically the incidence of tuberculosis and influenza in relation to the war of 1914–18. (The value of the ten graphs accompanying the paper is unfortunately diminished by absence of captions to most of them.) He concludes that the war years 1914–18 saw the mortality from tuberculosis steadily rising, but only in early life; then "suddenly, in 1918 came the great influenza epidemic as a famine pestilence, which struck in the

same period of life previously selected by tuberculosis." Heaf and Rusby in another paper review in detail the present position of tuberculosis. They discuss the pre-war background, the period of anticipated bombing, the effort to return to normal services, mass radiography and the examination of recruits, the threat of invasion, the period of intensified bombing, evacuation and tuberculosis, nutrition and rationing, rehabilitation in wartime, medical education, and "the future." There is much in this comprehensive review that will give food for thought to all tuberculosis workers, even if they may not agree with some of the views expressed by the authors. Perhaps the picture drawn of the pre-war background is far too rosy. It is said, for example, that "the strenuous efforts of Hawthorne and Esther Carling to obtain a safe milk supply *throughout the country* [our italics] were at last reaping their reward." Although due importance is given to rehabilitation, too little is said about institutional treatment; this is still so unsatisfactory that even before the war only an insignificant proportion of sputum-positive patients were discharged as quiescent. Finally, it is said that "too scathing a criticism" would be out of place in considering the policy adopted of evacuating tuberculosis institutions to make room for air-raid casualties. But the evacuation of these institutions before alternative arrangements had been made for the treatment and care of the large number of tuberculous patients affected emphasizes how uninformed is the official attitude to this common infectious disease, the most important cause of death in adolescence and early adult life.

PROBLEMS OF DENTAL CARIES IN CHILDREN

The aetiology and prevention of dental caries are complicated, and the subject is controversial. It is clear that individual cases can prove nothing, but unfortunately for those who want to give the best advice statistical studies of large numbers of children are likely to be difficult to interpret. Such a criticism, implying a lack of statistical training in the reader, may be made of an interesting study by B. R. East and Hilda Kaiser[1] on the relation, in rural American children, of dental caries to sex, age, and environment. These workers hoped to throw some light on the part played by vitamin D in the prevention of caries by studying the mean caries rate of children living in areas where climatic and other conditions were known to produce variations in the amount of solar ultra-violet radiation at the earth's surface, or to modify the conditions of exposure. They selected three climatic variables: mean number of hours of sunshine per annum, latitude, and mean winter temperature. The incidence of caries in children in 358 rural or semi-rural counties of twenty-four States of the U.S.A. was taken from data collected under the direction of the American Dental Association and the U.S. Public Health Service. Rural children were chosen for study because it was thought that they would be ethnologically more uniform than city children. White children only were studied, in order to exclude so far as possible the variable which cutaneous pigmentation might introduce. The caries rate at three different age periods (6 to 8, 9 to 11, and 12 to 14 years) for each sex was correlated with each of these climatic variables, and from a calculation of the correlation coefficient it is concluded that a statistically significant association could be established. But since the climatic variables were to some extent dependent on each other, it was desirable to measure the relation of the caries rate and each of the independent variables free from the influence of the remaining two. This was achieved by the statistical device of a partial regression equation. From this it is seen that the relation of dental caries to latitude and sunshine is what might be expected from the measures of ultra-violet solar radiation if vitamin D is an aetiological factor in caries. The greater the amount of sunshine available at a given place the lower is the caries rate. The more northerly a county the higher is the caries rate of the children. It appears that when the overlapping influences of sunshine and latitude are separated out there is little relation of winter temperature to caries rates except in the oldest and youngest groups of girls. The suggestion is made that the younger girls are more likely than their brothers to be kept indoors when the weather is cold and that the older girls in country districts are likely to have indoor duties. Apart from these speculations, the facts and the statistical conclusions drawn from them seem to establish very clearly an environmental factor in the aetiology of dental caries; they point the way to at least one method for preventing and controlling this disorder—the supply of sunshine, natural, artificial, or "bottled," as a vitamin D supplement. A recent statistical study in these columns[2] enabled Irene Allen to point to another factor. She was able to show a fairly high negative correlation between the increase in the average caries figure at 5 years of age and the increase in the nutrition figure. That is to say, at this age the greater the increase in a specially chosen nutrition index (indicative of improvement in nutrition), the less the increase in dental caries. At 6 years of age the same relation was found to exist, but not at 7 years, when the position is complicated by the shedding of so many of the deciduous teeth.

It may be concluded that even in children who have not received any special dietary treatment an improvement in general nutrition, as gauged by the weight and height index, is found in conjunction with increased resistance of the deciduous teeth to dental decay. Thus yet another factor in the tangled story seems to be established and an obvious practical step indicated in prevention and control. The individual child, though deprived of sunshine and inadequately nourished, may still turn up with a good set of teeth to disconcert the investigator; but such an event is a rarity and should not influence those who aspire to prevent or control dental caries in the young.

DARK-ADAPTATION TESTS FOR VITAMIN A DEFICIENCY

Since our last reference[3] to night-blindness and vitamin A further reports have appeared of attempts to use modifications of the biophotometer for the determination of the vitamin A intake of human beings. Isaacs and his colleagues[4] use an adaptometer made according to the specifications of Hecht.[5] They stress the importance of having control subjects in their experiments and of statistical analysis of results to prevent the drawing of unsound conclusions. In their own work they were unable to produce recognizable vitamin A deficiency by giving large doses of liquid petrolatum (5 c.cm. per kilogramme body weight) daily for periods up to 131 days in twenty-eight normal young adults. During this time twenty-nine untreated normal young adults were also under observation. Moreover, a diet containing only 74 U.S.P. units of vitamin A daily failed to produce definite measurable visual evidence or subjective signs of deficiency in three subjects in forty-three to forty-nine days. Nor when they

[1] *Amer. J. Dis. Child.*, 1940, **60**, 1289.

[2] *British Medical Journal*, 1941, **1**, 44.
[3] Ibid., 1940, **1**, 536.
[4] *Arch. Ophthal.*, Chicago, 1940, **24**, 698
[5] *J. optic. Soc. America*, 1938, **28**, 269.

were given massive daily doses of 300,000 U.S.P. units of vitamin A with 2,700 units of vitamin D in the form of a vitamin concentrate did they show any improvement. There was some trend towards increased dark-threshold levels between September and December in both the experimental and control groups. These workers conclude that the standard of vitamin A intake on which subjects are judged to be deficient is questionable, and that the procedures being used for measurement are probably recording something other than vitamin A deficiency. Blanchard and Harper[6] used a regenometer which also conformed to the specifications laid down by Hecht. It breaks down the visual purple of the retinal rods by a bright light and then measures the speed with which this rod pigment is regenerated. It measures the length of time required by the subject to perceive light of a fixed intensity instead of the intensity that can be perceived at a given moment. Ten students of 19 to 24 years of age were fed on diets low in vitamin A (300 to 550 U.S.P. units per day). At first the times required to see the test light varied from one to three minutes. As the time of the low vitamin intake went on, the time needed to see the test light rose to four to twenty-four minutes, the increase being gradual at first but more rapid later. On being given extra vitamin A improvement was detected in one to three hours, and a return to the normal range was obtained within two to ten days in six subjects, and in rather longer times in three more. The dose required for this was 1,500 to 3,600 U.S.P. units a day. Massive doses up to 250,000 U.S.P. units were not proportionately more effective than the smaller ones. A dose of 500 units caused some improvement but did not restore the subject to normal. Experiments with the biophotometer were made on the same subjects at the time when the regenometer recorded the longest adaptation times. Most of the subjects were found to be within the normal range by the biophotometer, and the workers conclude that the regenometer has a greater sensitivity in the detection of early stages of vitamin A deficiency. No clinical symptoms of vitamin A deficiency were observed during the course of the experiments.

ACUTE PULMONARY OEDEMA

Acute pulmonary oedema is considered by most clinicians to be a manifestation of failure of the left ventricle. The signs and symptoms are usually explained by the inability of the left ventricle to expel the blood delivered by the right ventricle, with consequent congestion in the pulmonary vascular bed. This explanation seems straightforward and reasonable; it provides a superficial explanation of the association of acute pulmonary oedema with disease or strain of the left ventricle, of the clinical picture, and of the benefit which results from venesection. Unfortunately, as experimental and clinical observations on pulmonary oedema have accumulated it has become clear that the validity of the "back pressure" or "left ventricular failure" theory can no longer be considered as established. In a recent review of the subject Luisada[7] emphasizes that pulmonary oedema cannot be produced experimentally by overloading the left ventricle or, indeed, by any mechanical procedure which would be expected to produce pulmonary congestion. He suggests that the primary factor is neurogenic, and that it is only when this is present that simple mechanical changes in the cardiovascular system can produce pulmonary oedema. The nature of this neurogenic factor is obscure. Various lesions in the central nervous system have been shown to lead to pulmonary oedema. Reflex stimuli arising in the heart and large vessels and in the hollow viscera may be precipitating factors. This review by Luisada is valuable, not because it clarifies the physiological processes involved in pulmonary oedema, but because it stresses certain inadequacies in the generally accepted theory that the disease is due to left ventricular failure. Another type of pulmonary oedema which is of more than topical interest is that produced by poison gas, and in the case of phosgene it has been stressed repeatedly[8] that vagal stimulation may be in part, at least, responsible for the pulmonary oedema. Only brief mention of this is made by Luisada, and he concludes that, although the inhalation of irritating gases may cause pulmonary oedema by direct damage to the capillaries, there are additional factors, nervous in origin, which are of importance.

[6] *Arch. intern. Med.*, 1940, **66**, 661.
[7] *Medicine*, 1940, **19**, 475.

NEUTRONS IN THE TREATMENT OF CANCER

The biological effects of fast neutrons have now been sufficiently investigated to permit their use in the treatment of cancer. Stone, Lawrence, and Aebersold[9] have had the use one day each week of a cyclotron, in which a beryllium target is bombarded by deuterons with energies of 8 million volts, producing a beam of neutrons with an intensity of 3 *n*/min. at a distance of 70 cm. from the target. The "*n*" unit is an arbitrary measurement of the intensity of a neutron beam, being that quantity of neutrons which produces the same amount of ionization in the thimble chamber of a Victoreen dosimeter as would 1 *r* of *x* rays. Thus the doses of neutrons and of *x* or gamma rays to effect the same biological change may be compared. As pointed out in a recent paper by Gray, Mottram, Read, and Spear,[10] neutron ionization is usually more efficient, even when the fullest allowance has been made for the uncertainties of neutron dosimetry. The ratio of the gamma-ray dose in *r* to the neutron dose in *n* for the same biological effect is usually of the order of 4, while in one case—the lethal effect on bean roots—it is as high as 11. Gray, taking into account the fact that neutron radiation produces in tissue seven times as much ionization as in an equal mass of air, whereas the absorption of gamma-ray energy is very nearly the same per unit mass of air and of tissue, has defined a neutron unit based on the increment of energy in unit volume of tissue, and this fortunately appears to be roughly equal to the arbitrary *n* unit of Lawrence and Aebersold. Gray and Spear find that there is a qualitative difference between gamma rays and neutrons in their inhibitory effect on mitosis in tissue culture, as well as the quantitative difference which alone has been found in previous experiments. As is well known, there is a threshold of intensity and dose below which gamma rays have no observable effect, but for neutrons this appears to be zero. Stone also describes a small qualitative difference in the erythema produced by neutrons: it appeared earlier and had more dry flaking of the skin than the corresponding *x*-ray erythema. The average single dose given on a 10 by 10 cm. field was 180 to 200 *n*, which had the same effect as 900 *r* of 200 kV *x* rays. Twenty-four patients with advanced lesions were treated in the preliminary experiment, and in every case there was some decrease in the size of both the primary growth and the metastases, in spite of the fact that they were single-dose treatments, not fractionated and not approaching the skin tolerance. Perhaps the most promising observation was that the metastases in the cervical glands responded better than the primary growth, although, in the absence of any measurement of the percentage depth dose, it is

[8] *Proc. roy. Soc. Med.*, 1937, **30**, 1935.
[9] *Radiology*, 1940, **35**, 322.
[10] *Brit. J. Radiol.*, 1940, **13**, 371.

difficult to assess its significance. Stone now has a new cyclotron of double the power to be used largely for clinical purposes, so that he is able to give fractionated treatment, each dose being 50 *n* at the rate of 5 *n*/min. He appears to have solved the problems of collimating neutron beams and of protection of the personnel, and his further results will be awaited with interest.

ECONOMY OF DRUGS IN WARTIME

Our *Supplement* this week reproduces substantially in full a memorandum, drawn up by the Therapeutic Requirements Committee of the Medical Research Council, on economy in the use of drugs in wartime. For the convenience of readers we have regrouped the complete list of drugs into the four categories adopted by the committee instead of printing them all in alphabetical order as one very long table with key letters. The committee, at the end of a prefatory note, makes it clear that this list is primarily intended to secure the wisest economy in drugs for human and veterinary use in this country and that other considerations may affect the importation or manufacture of drugs for the export trade. The committee also indicates the reasons underlying its classification of drugs and puts forward a number of points for the information and guidance of medical and veterinary practitioners when prescribing under the conditions of to-day. Economy in the use of a drug may be necessary in wartime because the drug is imported or because its manufacture at home diverts materials and skill from other essential services. An appendix (which we do not reproduce) gives a list of the drugs whose production the committee recommends should be encouraged either in the United Kingdom or in the British Empire. The pamphlet is published as M.R.C. War Memorandum No. 3 by H.M. Stationery Office, price 3d.

IMPETIGO

Impetigo contagiosa is perhaps the commonest of skin diseases. But although much work has been done upon it, both clinically and bacteriologically, since it was originally described and differentiated by Tilbury Fox nearly eighty years ago, the question of its aetiology is still open to debate. Soon after the beginning of the present century Sabouraud appeared to have proved that impetigo was always caused by the streptococcus. That the staphylococcus was often grown from impetiginous lesions was thought to be accounted for by the fact that staphylococci tended to swamp streptococci when grown under aerobic conditions; the staphylococci were considered to be secondary contaminations. Bullous impetigo was well known clinically, but the bullae were regarded merely as overgrown vesicles, and vesicular impetigo with typical "stuck-on" crusts was known to be of streptococcal origin. Of late years, however, the position has changed. Pemphigus neonatorum, which has always been recognized as closely related to bullous impetigo, and in point of fact can be considered as an extensive and virulent form of that eruption, is now generally acknowledged to be the result of a staphylococcal infection. A number of observers have also shown that bullous impetigo is always of staphylococcal origin. It now appears, therefore, that there are two types of impetigo which can usually be differentiated clinically, though the two types are sometimes mixed. At Jadassohn's clinic all the workers on this disease used to record their opinions about the type of each case, and after a while there was almost always unanimous agreement on whether a case was streptococcal, staphylococcal, or mixed. Epstein,[1] who originally worked in Jadassohn's clinic but is now in America, has lately done much to support the theory that there are two types of impetigo, which may become mixed in the same patient. He studied the staphylococci obtainable both from cases clinically characteristic of staphylococcal impetigo and from those of streptococcal impetigo, in which staphylococci could only be looked on as secondary contaminations. Epstein found that in the former every case studied yielded the same type of staphylococcus; in the cases which were clinically streptococcal numerous staphylococci were isolated.

The great difficulty in studying the bacteriology of the skin is that normally all types of micro-organisms are constantly present on it. With suitable methods of cultivation a great variety of cocci, fungi, and yeasts can be grown from the skin. Nevertheless the constant appearance of one type of staphylococcus in clinically distinguishable cases strongly suggests that this type is the causal organism. Epstein has also experimentally produced bullous staphylococcal impetigo by inoculation with a pure culture of *Staphylococcus aureus* obtained from lesions of bullous impetigo. Another point in favour of staphylococcal impetigo as a clinical entity is the fact that staphylococcal and streptococcal impetigo vary in frequency according to age groups, the former being relatively commoner in adults. It is also found oftener in some localities than others.

A TRIBUTE FROM NEW ZEALAND

Many kind things about our Centennial number have been said by readers at home and abroad. We take particular pleasure in quoting as follows from an editorial in the *New Zealand Medical Journal* for December, 1940:

"The official Journal of the parent body celebrated its centenary on October 5, 1940. Thus the birthday number of the most widely circulated and most influential medical periodical in the world was constructed and published in London after weeks of intensive air raids. To this creative effort, and indeed to the sustained excellence of the *British Medical Journal* under extreme duress, we do homage. Perhaps we in New Zealand, who can only speculate as to what the future has in store, will see some special significance in this particular number from Tavistock Square, which deviates not one iota from the traditional dignity and excellence of its forerunners and which betrays not by so much as a misplaced comma the magnitude of the difficulties which must have attended its birth. If men of great courage and high ideals can successfully prosecute the dissemination of professional knowledge under conditions of total war, which we can only dimly comprehend, then the ultimate future of our ideals and of our profession must be secure. We are told there is an intellectual black-out in Europe at present; but there has been no black-out of the *British Medical Journal* or, indeed, of any other of the well-known medical journals of the United Kingdom on which we rely so much."

[1] *Arch. Derm. Syph.*, Chicago, 1940, **42**, 840.

Mr. Gilbert H. Carr, honorary secretary of the American Committee for Air Raid Relief and of the Advisory Committee of the British War Relief Society of America, has been appointed Director-General of the American Ambulance, Great Britain.

FURTHER CASES OF CRUSH INJURY

COLLECTED BY THE MEDICAL RESEARCH COUNCIL SUBCOMMITTEE ON TRAUMATIC OEDEMA

With the kind permission of the physicians and surgeons concerned abstracts are appended of 11 case reports sent to the Medical Research Council. All these patients were pinned under debris for a period between three and twenty-six hours.

Group A: Fatal Cases.—Cases I to VI proved fatal between the fifth and tenth days: they ran a course similar to that of the cases details of which are given in the papers in this issue contributed by Bywaters and Beall (p. 427) and Mayon-White and Solandt (p. 433), with hypertension, blood-stained urine, oliguria, and oedema of the crushed limbs. These had plasma and serum transfusions only. Cases IV and V showed albuminuria only. Post-mortem examination revealed what appeared to be blood casts in the renal tubules in 4 cases.

Group B: Cases with Recovery.—Blood was found in the urine of Cases IX, X, and XI, and in the cases without haematuria (VII, VIII, and IX) the urinary output rose to normal on the fifth or sixth day. Case IX had no intravenous therapy, but the blood pressure rose to 176/110 mm. Hg. Although in this second group of cases the degree of swelling and the duration of crush differ little from those of Cases I to VI, yet the patients recovered, except for local tissue death.

Case I

A man aged 20 was pinned down by debris on the left lower leg for ten hours.

Examination.—Hb 150%. P. 135. B.P. 110/70. 1,120 c.cm. plasma given.

2nd Day.—Hb 130%. P. 110. B.P. 130/88. Intake by mouth 1 litre. Urine 650 c.cm.

3rd Day.—Drowsy. L. leg tense and swollen with pitting oedema. Pulse palpable; better on injured side. Anaesthesia of left leg. Fracture of tibia (radiograph). Slight vomiting. B.P. 155/100. Hb 120. Blood urea 188. Blood potassium 26 mg.; plasma chloride 480 mg.; blood phosphate 7.7 mg. per 100 c.cm. Urine (catheter) 205 c.cm., smoky, with pigment-cast sediment. E.C.G. showed slurring of QRS.

4th Day.—B.P. 150/100. Hb 100. Vomiting, drowsy, hiccup. Urine 100 c.cm., clear yellow. Microscopically: rare pigment cast. Intake 1,350 c.cm. 1 litre of 5% glucose given intravenously.

5th Day.—B.P. 160/100. Hb 98%. Vomiting, drowsy, slightly disorientated. Intake 990 c.cm. Urine 250 c.cm., clear. No sediment.

6th Day.—Urine 490 c.cm. A few casts.

7th Day.—Died very suddenly with marked stertor and irregular pulse. Observations on swelling of the leg were made and daily biochemical analyses of blood and urine were performed. These are included in the fuller account of this patient published in this issue at p. 432.

Necropsy (Dr. Miles).—Gross necrosis of muscles with fracture of tibia. Collapse of right lower lobes of lung. Kidneys pale. Microscopically: Tubular degeneration and pigment casts in the collecting tubules.

Case II

A youth aged 17 was pinned down by three dead bodies under timber and rubble for fourteen hours.

Examination.—Drowsy. P. 96, volume good. Abrasions on arms and whealing on right foot, leg, and lumbar region. Impaired movement of right chest.

3 Hours after Admission.—B.P. 100/70.

7 Hours after Admission.—Condition poor. B.P. 80/60. P. very poor (120). Some slight vomiting. Was given oxygen, morphine, coramine, 200 c.cm. of twice-normal reconstituted dried serum (M.R.C.), and 5 c.cm. desoxycorticosterone.

2nd Day (12 Hours after Admission).—120 120 c.cm. dark brown urine obtained by catheter; contained large number of blood casts. P. 104. B.P. 100/80. Was given plasma, 1,680 c.cm., 560 c.cm. 2½% glucose. B.P. rose to 140/90. Still vomiting; some brawny oedema of right lower abdominal wall. Hb 95%. Blood urea 101 mg./100 c.cm. Later—4.3% sodium sulphate, 560 c.cm., and 5% glucose, 1,180 c.cm. given intravenously. Total urine for the day 170 c.cm. Condition fair but restless.

3rd Day.—Urine 60 c.cm., dark, and contained a few casts. P. 104. B.P. 150/100. Vomiting, 900 c.cm. Sweating. Drowsy, restless, oedema of right foot. Intake 2,110 c.cm. by mouth. 5 c.cm. desoxycorticosterone and 5 minims adrenaline given. Blood urea 45 mg./100 c.cm. Hb 98%.

4th Day.—Patient more drowsy. Continual vomiting. Oedema of right leg. P. 112. B.P. 175/85. Blood urea 69 mg./100 c.cm. Urine 45 c.cm. A few casts still present. Sodium sulphate, 840 c.cm., and glucose saline, 1,680 c.cm. In spite of this, condition deteriorated. He became flushed, breathing stertorous, and moist sounds were heard all over the chest. P. 120. B.P. 180/80. Patient died on *5th day.*

Necropsy.—Lungs: fibrinous exudate over left lung and congestion. Kidney: cortex pale. Spleen: congested. Microscopically: pigment casts in the collecting tubules.

Case III

A man aged 28 was pinned under debris by the right leg for six hours.

Examination showed a few grazes only, no fracture (radiograph).

2nd Day.—Marked swelling of upper thigh. Plasma, 560 c.cm. preceded by saline, 1 litre, given intravenously. 1 hour after completion of plasma transfusion, 120 c.cm. of dark smoky urine passed.

3rd Day.—A small amount of urine passed.

4th Day.—A small amount of urine passed.

5th Day.—Began to sweat. A small amount of urine (a few ounces) was passed daily for this and the next four days, containing albumin, blood, and casts. The pulse varied from 55 to 80. B.P. rose to 150/100. Despite intravenous 50% glucose and mersalyl he died on the *10th day.*

Necropsy (Dr. Powys): 24 hours after death.—Slight right-sided dilatation of heart with petechiae of pericardial surface. Massive collapse of both upper lobes of lungs with oedema elsewhere. Liver: congested, cloudy swelling. Kidneys: cloudy swelling and mottled cortex. Microscopically (Dr. Bryson): blood casts in tubules.

Case IV

A girl aged 15 was buried under debris for thirteen hours. She complained of numbness of right leg and pain in right hip.

Examination: Large raised wheal over right buttock and across abdomen. Tender over right hip. Radiograph showed linear fracture of right pelvis. Pulse 124. B.P. 98/70. T. 100°. Has passed urine. Anaesthesia of right thigh, right leg, and right foot. Very thirsty.

10 Hours Later.—Restless. Mentally very alert. Hb 120%. Pallid, cyanosed, and vomiting. B.P. unobtainable. Plasma given intravenously. Urine 180 c.cm., obtained by catheter, containing albumin; sp. gr. 1016. Complained later of abdominal pain with rigidity in right iliac fossa. Blood drip started.

2nd Day.—B.P. 90/70. Less vomiting. Less abdominal pain. Urine 360 c.cm., nothing abnormal detected; sp. gr. 1018.

3rd Day.—Still very thirsty and mentally alert. Some return of sensation in upper right leg.

4th Day.—Tense swelling of upper right thigh. B.P. 100/70. Slight vomiting. Intake 1,140 c.cm. by mouth. Urine 90 c.cm., containing small amount of protein, moderate number R.B.C., and nothing else abnormal except a few bacilli. Blood urea 228 mg./100 c.cm.

5th Day.—Tense oedema of right thigh, right leg. Vomiting, hiccup. Cystoscopy showed small amount of blood at base of bladder. Blood urea 360 mg./100 c.cm. Clotting times done. 200 c.cm. 50% sucrose given, and later intravenous saline.

6th Day.—Condition worse. Mentally still very alert. Pulse irregular. B.P. not obtainable. Hiccup, vomiting. Hb 90%. Blood urea 398 mg./100 c.cm.

7th Day.—Patient died in coma.

Necropsy.—Lungs: basal collapse. Haematoma in buttocks and near sciatic nerve. The left kidney showed yellow spots all over it and on the cut surface. Bladder showed oedema and a little fluid blood. Microscopically (Dr. Pragel): pigmented casts in collecting tubules and some hyaline materials in Bowman's capsule and convoluted tubules in the lungs. The lungs showed early bronchopneumonia and small areas of haemorrhage with a few capillary hyaline thromboses.

Case V

A man aged 35 was buried under debris with legs between planks for three to four hours.

Examination.—Swelling of right forearm, both thighs, and left calf, with a few abrasions and considerable whealing. Tenderness over pubis, with fracture of pubis (radiograph) but no displacement. P. 102. B.P. 102/70. Hb 150%. R.B.C. 7,200,000. Blood N.P.N. 76 mg./100 c.cm. Urine (by catheter) 150 c.cm., containing heavy albumin deposit. Exploratory laparotomy was done (? laceration of bladder). Following this a further 480 c.cm. of urine was obtained. B.P. 124/94. Total fluid intake for the day, 3.6 litres. Slight vomiting.

2nd Day.—Intake 720 c.cm. Vomiting 420 c.cm. Urine 390 c.cm. Hb 136%. R.B.C. 6,200,000. N.P.N. 120 mg./100 c.cm.

3rd Day.—Pulse 76. B.P. 140/104. Intake 1,320 c.cm. Vomiting 180 c.cm. Urine 450 c.cm. Hb 119%. R.B.C. 6,200,000. N.P.N. 144 mg./100 c.cm.

4th Day.—N.P.N. 168 mg./100 c.cm.

5th Day.—Hb 108%. Faint trace of albumin in urine.

6th Day.—Temperature rose, due to haemolytic streptococcal infection from left leg.

7th Day.—Died. Septicaemia.

Necropsy.—No visceral injury in abdomen or pelvis. Kidneys large (320 grammes), blurred definition of kidney markings. Petechiae in pleura and on heart surface. No microscopical examination made.

Case VI

A woman aged 27 was buried under debris (?) hours. On admission she passed a fair quantity of blood-stained urine.

Examination (2nd Day).—Cold, pulseless, and shocked. 5 pints plasma in 2½ hours raised B.P. to 110/70 and P. to 120. There was slight external bruising of chest and flanks.

3rd Day.—Started to vomit. No urine for 24 hours; 225 c.cm. blood-stained urine by catheter. 4 pints saline given.

4th Day.—Blood urea 164 mg./100 c.cm.

7th Day.—540 c.cm. bloody urine passed, with clots. Caffeine and sodium salicylate grains 7 given subcutaneously.

8th Day.—Bloody urine again, with clots. Patient perfectly rational.

9th Day.—11.30 a.m., patient suddenly died "for no apparent reason."

Necropsy.—Macroscopically: cystitis only. Microscopically (Prof. G. R. Cameron): Lung showed pulmonary oedema. Liver and spleen normal. Kidney showed finely granular exudate in Bowman's capsule and convoluted and collecting tubules. Blood casts and free red cells in the lumen. Focal haemorrhages interstitially. Extensive subpelvic extravasation of blood.

Case VII

A man aged 34 was crushed beneath debris, with pressure on both lower limbs, for twenty-two hours.

Examination.—On admission cheerful; no shock; erythema on legs, with numbness and difficulty in moving them. P. 120. R. 18. T. 100°.

2nd Day.—P. 100. Intake 3,510 c.cm. by mouth. Vomiting, 2,100 c.cm. Urine 300 c.cm.

3rd Day.—Abdominal rigidity. Intake by mouth 60 c.cm.; by vein, plasma 560 c.cm., saline 1,120 c.cm., 4% dextrose 1,120 c.cm. Vomiting, 750 c.cm. Urine 420 c.cm.

4th Day.—Intake by mouth 1,920 c.cm. By vein the same as previous day. Vomiting, 930 c.cm. Urine 420 c.cm. P. now 90. Both legs swelling rapidly and becoming oedematous.

5th Day.—Intake by mouth 1,650 c.cm.; by vein 600 c.cm. No vomiting. Urine 2,190 c.cm. P. now 80.

6th Day.—Urine over 660 c.cm. Evacuated to country.

Examined at base hospital on the sixth day. Anaesthesia and oedema of the foot, with skin sloughs. All pulses palpable. Extremely excitable. B.P. 120/70. Urine sp. gr. 1010 Guaiac test negative. No albumin. Volume about 2 litres daily.

10th Day.—Blood urea 192 mg./100 c.cm. Hb 85%. B.P. 135/88.

13th Day.—Blood urea 84 mg./100 c.cm. Urea clearance 50–60%. B.P. 126/84.

14th Day.—Blood urea 43 mg., plasma chloride 538 mg. per 100 c.cm. B.P. 126/80.

16th Day.—B.P. 126/84. Urine normal.

21st Day.—Blood urea 60 mg./100 c.cm. Urea clearance 45–55%. Slough separating over right outer shin.

25th Day.—Blood urea 30 mg./100 c.cm. Granular and cellular casts in urine in centrifuged deposit. Slough separated—tendons exposed.

3 Months.—Urea clearance 55–68%. Blood urea 30 mg./100 c.cm.

4 Months.—Apparently recovered except for slowly healing ulcer on right outer shin extending down to bone and tendons. Feels well, and ambulatory with leg in plaster. B.P. 110/70. Blood urea 28 mg./100 c.cm. Urea clearance 69–71%. Urine sp. gr. 1012. Nothing abnormal.

Result.—Recovered.

Case VIII

A woman aged 28 was trapped under debris for twenty-six hours. She complained of numbness and inability to use the left arm and left leg.

Examination.—"Shocked," with shallow gasping respiration. Subnormal temperature. P. 124. The left chest was flattened and showed poor air entry but no fractured ribs. Apex beat not displaced. The left leg showed oedema and pressure blisters. There was numbness on the left side of the body. Blisters also on right buttock and left shoulder.

2nd Day.—Hb 104%; T. 100.6°; P. 140. Intravenous plasma 150 c.cm. was given, leading to rigor, followed by 2,400 c.cm. dextrose (4%) saline. Hb fell to 90%. P. 110. Urine 300–350 c.cm.

3rd Day.—Fluids by mouth, 3 litres. Urine output 300–350 c.cm.

4th Day.—Fluids by mouth, 3 litres. Urine, 960 c.cm.

5th Day.—Fluids by mouth, 3 litres. Urine, 1,530 c.cm. The left thigh extremely oedematous; a large sloughing area on right buttock, which in the next few weeks separated to expose the gluteus maximus.

10th Day.—Sulphapyridine and blood transfusion given.

5th Week.—Granular and hyaline casts found in urine.

Result.—Recovered.

Case IX

A man aged 31 was buried under debris compressing both legs from below the knees for seventeen hours.

Examination.—Condition good. B.P. 110. Legs painful, with three small abrasions. Loss of touch, impairment of pain sensation, and some loss of muscle movements in both legs below the knee. Urine 390 c.cm., blood-stained. Intake by mouth ? 1,320 c.cm. Pulse rose from 68 on admission to 120 five hours later.

2nd Day.—B.P. 176/110. P. 110. Intake by mouth 2,790 c.cm. Urine 150 c.cm., blood-stained, at 4 a.m. 360 c.cm. clear urine subsequently.

3rd Day.—Now considerable swelling of legs. Intake over the next few days by mouth ranged from 1,260 to 2,670 c.cm. Urine output 720 c.cm., 750 c.cm., 600 c.cm. on succeeding days, rising abruptly to 1,740 on the eighth day.

16th Day.—Still gross oedema; skin glossy, flushed, and hot, with pitting oedema.

4th Week.—Oedema now almost disappeared.

Result.—Recovery.

Case X

A girl aged 17 was buried under debris for thirteen hours.

Examination.—Drowsy; abrasions to face; fracture of forearm; burns both hands and feet. B.P. 110/80.

9 Hours Later.—Restless. B.P. falling (90/80 and lower). Intravenous plasma and proseptasine given.

2nd Day.—B.P. 115/100. Swelling of right knee and of face. Over 360 c.cm. urine containing albumin; sp. gr. 1024.

3rd Day.—Left foot cold, blue, and mottled. Firm oedema below knee. No pulsation felt at ankle. Bruising of left thigh. Under gas-and-oxygen, multiple incisions, evacuating much fluid, made into deep fascia.

4th Day.—Condition poor; vomiting. 5% dextrose and heparin given intravenously. Foreign body removed from left eye.

5th Day.—Gangrene left toe.

6th Day.—Condition better. No more vomiting. Oedema less.

7th Day.—Transferred.

At Leavesden Hospital the left leg became less swollen but still showed anaesthesia. Amputation through the tibia was done (for gangrene). The muscles had undergone avascular necrosis. Three months after accident general condition good.

Case XI

A youth aged 17 was trapped by legs under debris for twelve hours.

Examination (36 hours after injury).—Restless. B.P. 120/74. P. 88. Pitting oedema left and right legs. Right foot blue and cold, and dorsalis pedis not pulsating. Macroscopic haematuria, which diminished during the next four days. 8.5 grammes of sulphapyridine on first, second, and third days. 2 pints Group O blood on second day.

5th Day.—Circulation returned to leg, which showed blebs. No haematuria.

8th Day.—Blood urea 40 mg./100 c.cm. Several hyaline and granular casts noticed.

12th Day.—Superficial gangrene of leg. Considerable number of casts.

25th Day.—Hb 60%. Osteomyelitis and osteoperiostitis of tibia and fibula.

47th Day.—Muscle slough separating.

Result.—Recovery.

It is to be hoped that in future cases particular attention will be paid to: (1) Presence of anaesthesia or whealing. (2) Oedema—daily extent and progression (circumference measurements). (3) Pulse in the limbs, and, if possible, oscillometric readings. (4) Blood pressure, initial and daily readings. (5) Initial haemoglobin measurements and biochemistry of blood (serum for potassium and urea). (6) Urine, daily from time of entry, quantity, colour, and examination for blood, albumin, and casts.

The Subcommittee on Traumatic Oedema of the Medical Research Council desires to thank the following for their kindness and co-operation: Mr. Romanis (Case I), Miss Margaret Louden (Case II), the Chief Medical Officer of the L.C.C. (Case III), Dr. Avery Jones and Dr. Abdullah (Cases IV and X), Dr. Pochin and Dr. J. Squire (Cases V and IX), Dr. Whittingham (Case VI), Prof. Christie, Mr. Naunton Morgan, and Mr. Hosford (Case VII), Mr. Naunton Morgan (Case VIII), and Dr. Bolton (Case XI).

AWARDS FOR GALLANTRY IN CIVIL DEFENCE

The award of the George Medal to Dr. O. M. Holden, medical officer of health, Croydon, is announced in a *Supplement* to the *London Gazette* dated March 7.

DR. OSCAR MADELEY HOLDEN: "A heavy calibre bomb hit a report centre, completely demolishing it. There were five telephonists in the room at the time, three of whom were killed instantaneously and two ultimately rescued alive. One of the latter was trapped under tons of debris, but was able to communicate with the rescue party personnel. It was seen that she had been severely injured. Dr. Holden, at great personal risk, crawled under the wreckage and proceeded in the most difficult conditions imaginable to administer morphia to her. Owing to the abnormally confined space in which he had to work Dr. Holden was only able to come out by crawling backwards. During the time he was working debris was continually shifting and he was in great danger of being buried under the ruins."

The award of the George Medal to Dr. D. C. Logan, assistant medical officer of health and resident hospital medical officer, Clayponds Emergency Hospital, and to Dr. M. Kamill, house-surgeon, Clayponds Emergency Hospital, is announced in a *Supplement* to the *London Gazette* dated March 14.

DR. DANIEL CRAWFORD LOGAN and DR. MOSTAPHA KAMILL: "A time bomb penetrated the roof of the diphtheria block at the Clayponds Hospital, coming to rest among debris on the floor of the bathroom, without exploding. Dr. Logan and Dr. Kamill, who had experienced the results of previous bombings on the hospital, arranged for the evacuation of the patients. They carried out their duties with coolness and courage, regardless of any danger to themselves, and prevented the possibility of great damage being done to the hospital buildings and to the houses of people adjoining. There is no doubt that by their initiative and devotion to duty Drs. Logan and Kamill saved many lives."

Local News

AUSTRALIA

The Australian Red Cross Society

The Charles Mackay Oration was delivered recently at the Institute of Anatomy in Canberra by Dr. J. Newman Morris, C.M.G., whose subject was the origin and growth of voluntary aid to the medical services in time of war. After a sketch of the policy and structure of the Red Cross movement, he dealt with the history of the Australian Red Cross Society, which was founded in 1914 as a branch of the British Red Cross organization, and in 1926 became a national society on its own. Voluntary aid detachments have been a recognized technical reserve of the Australian Army Medical Corps ever since the last war, and the administration is vested in a joint council as in Great Britain. One service of the Australian Red Cross in the present war was specially mentioned by Dr. Morris—namely, the organization of blood transfusion. It was considered necessary to provide an emergency transfusion service among women, who have readily volunteered, and the technical work has been done almost entirely by women doctors. The transfusion service of the Australian Imperial Forces has found this Red Cross emergency service of the greatest value, and it has been worked in association with the Commonwealth Serum Laboratories. The latest contribution of the women has been to give large quantities of blood serum, which is preserved and forwarded over-seas to be used for wounded men of the A.I.F. Other work of the Australian Red Cross has been the maintenance of a Red Cross unit in the Middle East, the provision of sixty-three ambulances for service with the Forces and of six mobile advanced dressing stations, and the establishment of convalescent homes for sick men of the Forces in three States. It is probable that since the oration was published, in November of last year, these provisions have been largely exceeded.

INDIA

The Health of Bombay

The Province of Bombay has a population of close upon twenty millions and a birth rate of 39 per 1,000, which is nearly three times the birth rate of Manchester. The infant mortality rate (152.7 per 1,000 births) in 1939 was the lowest ever recorded in the province. The increase of population is regarded with some disquiet. As the annual report of the Director of Public Health points out, at one time a high birth rate was taken as an index of the prosperity of the country. Evidently, an unhealthy population cannot be expected to have a high birth rate, but at the same time it is not impossible for a prosperous and healthy country to have a comparatively low one. A reasonably low birth rate is far to be preferred, says the Director, to the excessive one of over 50 per 1,000 which is recorded in several districts of the province. The death rate in Bombay (25 per 1,000) is going down, and the decrease applies to almost every one of the common causes of mortality. It is pointed out that the total death rate in recent years has been scarcely affected by any decrease or increase in deaths due to epidemic diseases. It depends mainly upon constitutional rather than accidental causes. The latter have in recent years been brought under control to a great extent, so that it is now unusual for an epidemic to run like wildfire and cause enormous waste of life as formerly. The only diseases for which an increase in the death rate is recorded are plague (a slight increase) and smallpox (a considerable increase, from 0.24 per 1,000 in 1938 to 0.38 in 1939). Although there was a decrease in the number of deaths from tuberculosis, 23,195 persons died from the disease in the year 1939, and the total deaths due to all epidemic diseases do not amount even to one-half of the deaths caused by tuberculosis. It would therefore be unwise to assume that the spread of tuberculosis has been checked, or that the factors causing constitutional diseases—low standard of living being the most prominent—have been removed. The cholera epidemic of 1939 was of a mild nature, and the number of deaths was the lowest since 1932. The annual report bears encouraging witness to the growth of urban and rural sanitation in Bombay and the activity of many health movements, especially maternity and child welfare and school hygiene.

Reports of Societies

WAR INJURIES OF THE SPINE

A meeting of the Section of Surgery of the Royal Society of Medicine was held on March 5, Mr. J. B. HUNTER presiding, at which a discussion took place on "War Injuries of the Spine."

Mr. JULIAN TAYLOR, after some reference to the historical aspects of the subject and his own experiences during the last war, said that the injuries fell into two classes, the larger being what might be called the civil group, in which motor cars or falling masonry were the usual causes; and the smaller, the group of injuries caused by projectiles. The damage to the cord and the effect on the functions of the victim were similar in both classes, and in all cord injuries and in both groups there was a high proportion of neurologically complete interruptions. Interruption of conductivity of the cord might be due to one or more factors. Thus there might be complete severance, physiological interruption due to crushing without section, or what was called spinal concussion or shock. These were instantaneous events, but at the site of crushing there usually occurred some bleeding later, which tended to spread up and down the substance of the cord in more or less cylindrical form, giving place still later to cavities containing clear fluid.

The effect on the conductivity of the cord of all these agencies, except severance, might be transient; part of the immediate effects might be due to temporarily acting conditions, part to permanent. Theoretically, by adding a fraction of the temporary to a fraction of the permanent a complete interruption might be made, and thus it would not be possible to say what chance there was of improvement of a temporarily complete paraplegia. Unfortunately there was no such ground for uncertainty, for it was the experience of Sargent and of Trotter that with early complete paraplegia no return of function was to be seen. The speaker himself had never found evidence of recovery in such cases.

Interruptions of the Spinal Cord

Haemorrhage into the substance of the cord was capable of producing increasing degrees of interruption after an accident. The increase was due at first to continued effusion of blood, and later to the reaction to its presence in the tissues of the cord. A partial lesion might be recognized clinically by persistence below its site of skin sensibility or of motor power or of reflex activity. There was such a thing as the academically incomplete lesion—one which showed during its later history that it was not quite complete, but which gave back no useful function, although some slight return of sensibility might be seen.

Although partial lesions revealed their nature at once or in an early stage, he did not wish to imply that they proceeded to complete recovery either invariably or rapidly. But the fact that a lesion was a partial one indicated that the violence which reached the cord was slight, and thus it might be hoped that useful recovery would occur, although a year or longer might elapse before recovery was established. These partial lesions were obviously the only ones which, from the point of view of the cord, were worth operative or manipulative treatment with the object of relieving pressure. Experience of the present war had suggested that partial lesions were of great rarity in both the groups he had named. Dr. Gordon Holmes in his Goulstonian Lectures in 1915 mentioned 300 cases in only forty-five of which were incomplete lesions found. In less than one-sixth of the projectile cases the question of surgical relief of pressure might be considered, and in the majority even of these it was likely ultimately to be rejected.

Injuries caused by Projectiles

In an incomplete lesion the presence of metallic or bony fragments might cause persistent pressure on the cord, and these should be removed. It was rare for metallic fragments to be held up in the spinal canal, for a projectile which had the energy necessary to penetrate the canal or fracture its walls had usually enough left to carry it out again into other tissues. Another reason for removing metallic fragments, irrespective of the position of the foreign body, was the prevention of infection. As an infected track must pass by the cord or meninges, an infected wound was an obvious source of meningitis. When entrance wounds were suppurating freely, as was usually the case, the rule should be to bring the wound to as clean a state as possible by a superficial drainage operation before removing the foreign body. Meningitis in penetrating wounds of the central nervous system was extremely common in neglected cases, but mortality from it was low. In discussing the treatment of the infected focus Mr. Taylor mentioned the new bactericidal drugs, but stressed his view that these were adjuvants to surgical treatment, though he agreed that sulphapyridine had in certain cases cleared up staphylococcal meningitis when no other treatment, not even by lumbar puncture, had been employed.

In at least five cases out of six, transport, nursing, and management of the bladder were the beginning and end of treatment. The primary needs of the patient with the anaesthetic back were distributed pressure, continual changing of the sites of pressure over bony prominences, and cleanliness of the skin. Whereas water beds and sorbo-rubber mattresses permitted all of these, plaster beds invariably gave rise to bedsores.

Management of the Bladder

Finally, Mr. Julian Taylor dealt with the management of the bladder, the most important duty of the medical attendant. When there was retention of urine, which almost

invariably occurred, there were three methods available: regular catheterization, the tied-in catheter, and suprapubic drainage. Each had its disadvantages. For the patient who might recover his vesical function he recommended regular catheterization, and the same procedure for the patient likely to develop automatic micturition. For the patient who was not going to improve or to develop automatic micturition —for example, one suffering from a cauda equina lesion —he recommended suprapubic cystotomy with lavage of the bladder at low pressure. For the patient who had to travel a long distance in an ambulance a catheter tied in and scrupulously arranged was probably the least harmful expedient.

Types of Fractures

Mr. R. WATSON JONES divided injuries of the spine into three groups: compression fractures of the vertebral bodies, avulsion fractures of the transverse and spinous processes, and penetrating wounds of the spine. Investigations he had pursued in recent weeks showed that the surgeons of the Royal Navy, of the Royal Air Force, and of the Emergency Medical Service were faced to-day, exactly as in days of peace, with a very large number of uncomplicated fractures and a very small number of spinal cord injuries. He mentioned a form of fracture almost unknown in this country until twelve months ago. It was called "shoveller's fracture," in which the spinous process was torn off the vertebra by violent contraction of the rhomboid muscles at the moment that a labourer drove his shovel into wet clay or flung the laden shovel into the air. Its recent frequency was among those engaged in excavating shelters, digging trenches, or clearing debris.

Of vertebral body fractures the simple wedge compression was by far the most common. It was likely to be sustained by the dock labourer who fell into the hold of a ship, the window cleaner who fell from his ladder, or the steel erector who fell from scaffolding. In another type of fracture in which the vertebral body was comminuted the injury was usually due to the fall of a weight across the shoulders, as in the case of a miner trapped by a fall of roof. Fracture-dislocation, most often seen in car accidents, was, like comminution, due to acute angulation, but with a traversing momentum which carried the upper segment of the spine forwards so that the spinal cord was often injured. In the Royal Navy the most frequent war injury of the spine was a simple wedge compression of one or more lumbar vertebrae, with or without a fracture of the os calcis. It was often caused by jumping from the deck of a torpedoed ship or by the explosion of a mine below the vessel. In the treatment of these lumbar fractures two points were important: (1) the compression could be completely reduced by hyperextension of the spine by the two-table method, but the limit of hyperextension must be reached; (2) the fully extended position must be maintained by an adequate plaster jacket for not less than three months.

Fractures sustained by Airmen

In the Royal Air Force fractures of the lumbar region might again be sustained as a result of parachute or crash landings, but the commonest fracture was one in the upper half of the dorsal region of the spine. The reason for the localization lay in the fact that the pilot was partly fixed to the back of his seat by a special harness which prevented forward movement of the shoulders, so that if a fighter aircraft crashed the pilot could not double up in the ordinary way at lumbo-dorsal level, but the momentum still tended to carry his head forward, so that the site of angulation of the spine was the upper dorsal region.

The reduction of these high dorsal fractures was very difficult, but for that very reason perfect replacement was relatively unimportant. As the injured vertebra lay in the middle of one of the arms of leverage it was in a relatively immobile segment of the spine, and in such cases perfect function was compatible with definite compression of the vertebra. In treatment the spine was extended as much as possible, and a wing of plaster was added across the front of each shoulder to maintain extension of the upper dorsal region, but not to include the cervical region and head. Immediately after reduction of the fracture hyperextension exercise was undertaken. With such treatment it had been unnecessary to immobilize the spine for more than two months.

Prognosis in the lumbar region was relatively good. More than half the cases of fracture-dislocation at this level with paraplegia made a complete recovery. In the dorsal region, on the other hand, the spinal cord almost completely filled the spinal canal, and recovery from paraplegia was not observed in more than 15 or 20% of cases.

Spinal Injuries in Air-raid Casualties

Mr. Watson Jones went on to say that his inquiries showed that surgeons in the Emergency Medical Service who were treating air-raid casualties had to deal with only a small number of spinal injuries. No doubt the mass of masonry which fell on air-raid victims if sufficient to fracture the spine was also sufficient to kill. The few cases that had occurred had been in air-raid shelters, the roof of which had crashed down on to the shoulders of those within. The type of injury sustained was a comminuted fracture or fracture-dislocation of the cervical region.

In the treatment of cervical fracture-dislocations he emphasized the value of skeletal traction from the skull. This was the safest method of reduction and, moreover, the best method of preventing redisplacement. Skull traction relieved pressure on the cervical cord because it not only reduced the bone displacement but by maintaining a distracting force on the intervertebral spaces it encouraged replacement of retropulsed intervertebral disk material.

All the injuries so far discussed were the flexion variety of fracture or fracture-dislocation, and in conclusion Mr. Watson Jones mentioned the rarer hyperextension injuries, as instanced in a sailor who fell on to the deck of a destroyer and sustained violent hyperextension of the spine, with a traumatic spondylolisthesis, so that all the lumbar vertebrae were dislocated forwards on the sacrum. That particular case when he saw it was several months old and it was impossible to attempt reduction, but he believed that the method of reduction he had described for congenital spondylolisthesis would have been effective if applied at an early date. In this method the patient lay face upwards with head and shoulders supported on a table, the hips flexed to the right angle, and vertical traction was applied to the thighs so that the lumbar curve was flattened and the pelvis pulled forwards. Even in congenital spondylolisthesis improvement of position was possible, and in a traumatic case perfect reduction should be obtained.

Technique of the Plaster Jacket

Mr. K. I. NISSEN said that the experience at the Orthopaedic Centre, where in most of the cases received the injuries were at least a fortnight old, was that every plaster jacket had to be removed either immediately or within the first week, on account of faulty technique in its application. In some cases there was incomplete hyperextension and in others incomplete or faulty padding, while a number of plasters were rendered ineffective by excessive trimming above the pubic region and also low down on the sternum. For obtaining hyperextension he had found of great service a sling made of stout canvas about 4 in. wide with padding of 1/4-in. felt, but with the padding completely removed over the front part of the sternum and replaced by some soft materials, such as chamois leather. The sling was used to take the strain off the arms, multiple injuries of which hindered the application of the plaster jacket. He stressed the need for carrying out suprapubic drainage high rather than low in the abdomen. If such drainage were attempted it should be, particularly in a cauda equina lesion, 1½ in. above the pubic crest. He added that the amount of reduction obtained in the cases of spinal fracture which had come to the centre had been most disappointing. If a week had elapsed after the injury, every day diminished the chance of getting a satisfactory reduction, and after two or three weeks the possibility had practically disappeared. The plaster jacket then served the purpose of splintage and not its primary purpose of facilitating complete reduction.

CASE OF ADRENO-CORTICAL SYNDROME

At the last meeting of the Section of Medicine of the Royal Academy of Medicine in Ireland, with the president, Dr. R. H. MICKS, in the chair, Dr. KEVIN MALLEY gave an account of a patient with adreno-cortical syndrome.

The patient was a girl of 14 with a family history of virilism on the maternal side. A sister aged 11 was believed to be suffering from the same complaint. Abnormality was first noticed at the age of 9, when hair appeared on the pubes and both axillae; at the same time she grew fast and showed excessive muscular development. Three years later a "growth" appeared in the vagina. She had not menstruated. When she was 13 soft downy hair appeared on her upper lip and "beard" region. On examination she was found to be 5½ in. under normal height and 5 lb. under normal weight for her age and sex. She showed masculine configuration and voice, and had acne vulgaris on the hairy regions round her mouth. She had dense hair on both legs, pubic hair reaching from the vagina to the umbilicus, and marked muscular over-development. The clitoris was enlarged and resembled a penis; the labia majora were well developed and the labia minora poorly formed. The uterus was small. The chest and sella turcica appeared normal to *x*-ray examination, and the fundi of her eyes and the basal metabolic rate were also normal. She had slight polycythaemia, diminished sugar tolerance, and slight reduction of sodium and increase of potassium in the blood. Blood calcium, phosphorus, and cholesterol were normal. Dr. Bradshaw had reported an increase of 17-ketosteroids and remarkable excess of excretion of sodium pregnandiol. At laparotomy (by Mr. P. J. Smyth) both adrenals were found enlarged.

Dr. T. G. BRADSHAW described his investigations on twenty-four-hour specimens of urine over a period of a month: excretion of 17-ketosteroids varied from 50 to 160 mg. per twenty-four hours, with an average of 58 mg.; the sodium pregnandiol glycuronidate output varied from 80 to 297 mg. per twenty-four hours with an average of 142 mg. The normal figure would be 6.75 mg. for 17-ketosteroid excretion and 0 to 10 mg. of sodium pregnandiol glycuronidate in the second half of the menstrual cycle. The 17-ketosteroid excretion in this patient was consistent with that found in cases of adrenal tumour. Dr. G. C. DOCKERAY mentioned arrhenoblastoma and hypernephroma of the ovary as points in the differential diagnosis. Dr. OLIVER FITZGERALD asked if this case demonstrated deficiency of the adrenal cortex and its hormone. Dr. D. K. O'DONOVAN said that in actual practice the diagnosis of this case was extremely difficult. He thought the girl was very likely to go into an acute Addisonian crisis if not operated on, but the greatest possible care must be taken at operation. There was definite evidence that the cortical hormone was of two types. Dr. W. R. F. COLLIS thought an operation would be very dangerous, but it was worth the patient's while to take a pretty big risk. Perhaps deep *x*-ray therapy could be applied to the left suprarenal. The sodium and potassium content might give a lead in the right direction. Dr. O'C. DONELAN said it was very rare to find this type of acne in a girl so young; acne did not usually begin until about six months before menstruation. Large doses of follicular hormone had given good results in some cases of acne. Mr. J. C. FLOOD said he hoped the adrenal gland would be investigated by the pathologists if it were removed. The results of operation had not been too bad in Broster's series. In most of these cases the sella turcica was smaller than normal.

Dr. MALLEY, in reply, said he would put the patient on a test diet, deficient in sodium. Operation would only prevent a progression of the syndrome. It was rather satisfactory that both glands were enlarged, as usually an adenoma was unilateral.

At a meeting of the Socialist Medical Association of Great Britain, held in London on February 22, Dr. STARK-MURRAY gave an address on "An Approach to Socialized Medicine." He emphasized the fact that the outline he now presented was the result of years of patient work on the part of S.M.A. members and had not been born overnight. A great change had taken place in the attitude of the profession, and there was a demand for a new organization of medicine, especially from the public. Nationalization did not necessarily mean socialism, as events in Europe had shown. The socialization of medicine might well anticipate that of the whole State. He stressed the importance of nutrition and other amenities without which the best medical service would be ineffective. The service would be organized in local health units, which must be democratic. Every patient must have a home-doctor service, a health centre, and a hospital service. The service must be free for all. Doctors must have regular hours of duty and leisure and that security of living standards which would be given by a full-time salaried service.

Correspondence

Local Anaesthesia in General Surgery

SIR,—Too often the claims of local anaesthesia are passed over without receiving the attention they deserve. Mr. Harold Dodd's article (September 14, 1940, p. 345) stimulates me to relate our experiences in this connexion.

We were forced to practise this type of anaesthesia because war conditions prevented our obtaining adequate supplies of liquid anaesthetics. None of the gases have ever been obtainable in this part of the world. Novocain can be sent in a flat letter through the post, and by air if necessary, in quantities sufficient for many operations with very little difficulty. Local anaesthesia solves a problem for the hospital administrator.

My surgical colleague, Mr. J. C. Pedley, has not found his art restricted on this account, but as wide a variety of operations as our practice requires have been performed. I am not at present in a position to produce figures, but the following list will show the type of work that has been accomplished; All operations within and around the eyeball and orbit. All dental operations and operations on the soft tissues of the mouth and larynx. Dissection of the glands of neck—usually for tuberculosis. Thyroidectomy for large non-toxic adenomata (thyrotoxicosis never occurs in this part of China). Laparotomies—chiefly for hydatid and ovarian cysts. Caesarean sections, with and without hysterectomy, for cases of osteomalacia with obstructed labour. Strangulated herniae. All operations on the rectum, perineum, and external genitals, including anterior colporrhaphies and circumcisions. All operations on the bones and joints of the limbs.

In all these cases local infiltration of the anaesthetic is never performed, but the nerves or nerve plexuses supplying the part are blocked at some distance from the seat of operation. This avoids the bugbear of post-operative sloughing, such as is so commonly seen after circumcisions done under "local anaesthesia." For this reason we prefer to use the term "regional anaesthesia." We are discarding spinal anaesthesia in favour of this type because of its general symptoms. The advantages to the surgeon are many. He can operate in comfort, knowing that his patient is presented with no appreciable anaesthetic risk. He is never obstructed by the anaesthetist or the anaesthetic apparatus when working in the region of the head. He can enjoy perfect anaesthesia over as wide an area as he desires.

It requires patience and practice before the anaesthetist is as skilled in producing this type of anaesthesia as he is in using the "generals." But any skill worth the name is only attained by hard work. Even the most lengthy procedures such as paravertebral blocking can be performed within fifteen minutes. The anaesthetist is then free to assist the surgeon. When there is a shortage of help the surgeon can be his own anaesthetist. There would be no need to scream about the use of unqualified anaesthetists in wartime if each surgeon would learn to perform these manœuvres.

The gain to the patient is inestimable. Occasionally we use premedication such as morphine. Our patients—Chinese, Moslems, and Tibetans—are of average sensitivity. The patient avoids the unpleasant effects of general anaesthesia, both before and after the operation. If rightly handled in the theatre the patient suffers no mental trauma, but is infinitely better off for not having been forcibly removed from and brought back into consciousness. He is no longer a problem to the nursing

staff when he returns to the ward, and after-pain is considerably reduced.

This is surgical anaesthesia as distinct from medical anaesthesia. Are we slow in developing this art because surgeons and physicians are too circumscribed in their spheres?—I am, etc.,

ROBERT A. H. PEARCE,
Late Medical Superintendent, China Inland Mission Hospital.

Kaolan, Kansu, N.W. China, Dec. 24, 1940.

British Mosquitoes and their Control

SIR,—May I endorse the statement in your leading article on British mosquitoes and their control (March 15, p. 408) that the publication by the Ministry of Health of the memorandum by Lieut.-Colonel Sinton and Mr. Shute is "a most important summary of the whole situation, and should serve as a work of reference to all interested in British mosquitoes, whether from the point of view of natural history, of the public health, or of individuals who may experience mosquito nuisance in this country."

In the memorandum those who are specially interested in the subject are advised to obtain a copy of *The British Mosquitoes*, by J. F. Marshall. This is a volume of over 300 pages written at the request of, and published by, the Trustees of the British Museum. Mr. Marshall became interested in mosquitoes because they were an intolerable nuisance at Hayling Island. After studying them and their habits he began to destroy them in 1920, and did this so successfully that later the local sanitary authority assisted him financially and, I believe, has now made itself responsible for the cost of the work. In his enthusiasm for the work in 1925 he built and maintained, largely at his own expense, the British Mosquito Control Institute at Hayling Island, and here carried out many valuable researches on mosquitoes. I believe Mr. Marshall gave Surgeon Commander Given his first lessons in mosquito control. Given then started mosquito control at Portsmouth, and later was sent by the Admiralty to Singapore, where he did excellent work at the Naval Base. Mr. Marshall was awarded the C.B.E. for his work in 1936.

Mr. Marshall is one of a number of laymen who have become interested and done valuable work in the control of mosquitoes and of malaria, and it is right that their work should be recognized by medical men, not merely because it has been good work, but because such recognition will encourage other laymen to do likewise.—I am, etc.,

MALCOLM WATSON,
Director, Ross Institute of Tropical Hygiene.

London, W.C.1, March 14.

Chemotherapy in Acute Otitis Media

SIR,—As Dr. Jessiman has paid me the compliment of referring to some writing of mine in his article on chemotherapy and conservatism in acute suppurative otitis media (March 15, p. 399) perhaps you will allow me space for a few comments. It is a maxim with old soldiers that if you look for trouble often enough you will eventually find it. If Dr. Jessiman persists in his disregard for bacteriological examinations and minor surgery when using chemotherapy it is certain that he will eventually meet some humiliating experience.

As illustrations two recent cases may be quoted. A nurse was treated for acute suppurative otitis media with sulphanilamide without benefit. When I saw her it appeared as though a mastoid operation could scarcely be avoided, but bacteriological examination of the pus from the ear showed that the infection was purely pneumococcal and not streptococcal, and recovery followed without operation under treatment with sulphapyridine. It is pertinent to remark here that the *Staphylococcus aureus* and occasionally other organisms also sometimes, though rarely, cause acute suppurative otitis media. The second case is that of a child now in hospital treated by a junior medical officer in the manner described by Dr. Jessiman. The otitis media did not resolve in this case, and a mastoid operation was required. A paracentesis tympani at the right time would probably have avoided the mastoid operation, though naturally this is only speculation.

Dr. Jessiman admits the anxiety which his cases caused him, and he reminds me of a friend in whom years of residence in Ireland had engendered the habit of defying the law. It was his pride that for seven years he had never taken out a licence to kill game. He was, however, persuaded to repent and amend his ways, so that when one day an officer of the Inland Revenue appeared on the field he had provided himself with the necessary document. We are all familiar with the benefits of chemotherapy, and I hope that this trifling analogy and the illustrative cases will persuade Dr. Jessiman not to demand too much from this treatment, and to abandon his neglect of bacteriology and his defiance of the established indications for incision of the tympanic membrane.—I am, etc.,

London, W.1, March 16. LIONEL COLLEDGE.

Effect of Peritoneal Irritation on Intestinal Activity

SIR,—I read Mr. Victor Bonney's Bradshaw Lecture "The Functional Derangement of the Intestines that Follows Abdominal Operations" with great profit as long ago as 1935, and am grateful to him for the valuable suggestions contained in his letter (March 8, p. 377).

One of the great difficulties of clinical research in this field is the problem of quantitation. Anyone who has tried to estimate degrees of abdominal distension must have been surprised and chagrined, as I was, to find that it is a matter of the greatest difficulty to arrive at even an approximately constant base line. The explanation, I suppose, lies in the fact that a whole series of variables is involved, such as muscle tone, diaphragmatic displacement, and the like. An equation which takes cognizance of abdominal circumference, intra-abdominal tension, and the height of the diaphragm might perhaps give an approximation, but there must be many loopholes even in such an approach. A fruitful field of research would be opened by the investigator who could achieve a simple clinical method which would give reasonably constant results.

As to extraperitoneal operations, it is surely by no means certain that the external surface of the parietal peritoneum is not submitted to considerable surgical insult in the operations of prostatectomy and nephrectomy, and the submission that the distension of the intestine that sometimes follows these operations is in part at least the result of peritoneal irritation would be hard to refute.

The "agent" postulated by Mr. Bonney comes very near to describing sympathin, the effector substance of the postganglionic neurones of the sympathico-adrenal system, and it is possible that in sympathin we have the villain of the piece.—I am, etc.,

British Postgraduate Medical School, London, W.12, March 9. D. M. DOUGLAS.

Allergic Eczema and Cataract

SIR,—Referring to Mr. J. G. Milner's paper on this subject in your issue of March 8, I have seen two similar cases, one in 1936 and one more recently. Mr. Milner may be interested in a paper by L. A. Brunsting from the Mayo Clinic (*Arch. Derm. Syph.*, Chicago, 1936, **34**, 935). This reports 101 cases of atopic dermatitis (disseminated neurodermatitis) and ten cases of juvenile cataract occurring in that disease. A footnote records that since the article had been sent for publication the author had seen four further cases. The opacity of the cataracts bore no relation to the amount of *x*-ray treatment that had been given, and some of the most advanced had had little or no *x* rays at all. Moreover, the cataracts were, as in Mr. Milner's case, of a different type from that resulting from *x* rays.—I am, etc.,

London, W., March 10. A. C. ROXBURGH.

Primary Cerebral Thrombosis after Childbirth

SIR,—In their valuable contribution on primary thrombosis of cerebral veins following childbirth (*Journal*, March 8, p. 349) Drs. Purdon Martin and Sheehan, discussing the diagnosis of such cases, consider that the possibility of a cerebral embolus from thrombus formation in the pelvic or femoral veins as an aetiological factor is unlikely, since "this presupposes a patent foramen ovale." In the light of the recent investigations of Batson (*Ann. Surg.*, 1940, **112**, 138), to which

reference was also made in an annotation in the *Journal* (February 22, p. 284), it becomes evident that an embolism may reach the brain from a pelvic or femoral site without passing through the pulmonary circulation. Batson outlined a vertebral system of veins, which have free and valveless communications with those of the pelvis, abdomen, thorax, thoracoabdominal wall, and with the intracranial venous system, and in which there is a frequent reversal of flow. Radio-opaque material injected through the dorsal vein of human cadavers was seen to pass from the pelvic veins to those of the cerebrum without entering the lungs. These results are of the greatest value and serve to clarify a common problem—the mode of blood spread of tumours and inflammatory masses in the absence of secondary deposits in the lungs and of a patent foramen ovale.—I am, etc.,

London, W.1, March 8. J. SHAFAR, M.D., M.R.C.P.

Influence of Heredity on Breast Cancer

SIR,—In your report on the work of the British Empire Cancer Campaign (March 1, p. 329) part of the summary by Mr. J. P. Lockhart-Mummery of the seventeenth annual report of the Campaign is quoted. It reads: ". . . Although it has been known for some time that heredity can influence the incidence of breast cancer in mice, this should not be applied too closely to the problem in man, because the conditions of mating necessary to demonstrate the effect in mice —for example, very close inbreeding, necessitating brother–sister mating—never obtain in any civilized community." It is important for those interested in this problem to realize that when using highly inbred mice to elucidate the factors concerned in the genesis of breast cancer, all that is done is to exaggerate and concentrate certain characters which are normally present but widely dispersed in any mixed stock. Thus factors which would otherwise be lost to view can be studied and influenced at will in many individuals. The mouse is chosen because of its short life span and rapid powers of reproduction, but similar results can be obtained in the rabbit.

No one would deny that the Mendelian laws are as applicable to the human as to the tall and short peas which Mendel used in his original experiments. Yet Mendel could not have formulated the laws if he had not studied an obvious character in a quickly growing plant. Similarly, in the study of breast cancer the use of inbred mice is an invaluable aid to the elucidation of the problem in man. I am prompted to offer this point of view as a reply to the question as to whether it is justifiable for those engaged in cancer research to spend a great deal of time upon experiments in mice. I think it is. —I am, etc.,

University of Leeds, March 7. GEORGIANA M. BONSER.

Muscular Lesions in Somatic Pain

SIR,—I fully agree with Dr. Michael Kelly (March 8, p. 379) in impressing on the general practitioner the great and widespread incidence of muscular lesions and their importance in the treatment of patients complaining of pain the origin of which appears to be obscure. I, too, have stressed this very point in my papers. I also agree that our present conception of the origin of pain will have to be revised in a radical way. But it appears to me that in the first instance we have after R. Leriche (*The Surgery of Pain*, 1939, p. 28) to distinguish between experimental pain as produced in the laboratory by neurologists, and symptomatic or—*sit venia verbo*—pathological pain as occurring in diseases. On the other hand, the latest experiments of Sir T. Lewis and collaborators by injection of hypertonic saline into the muscles produced pain which seems to be related to, although not identical with, symptomatic pain, in which doctors are naturally much interested. In my opinion pathological pain is caused by abnormal vasomotor reflexes of parasympathetic (?) or, more likely, of sympathetic origin leading to a "vascular disequilibrium" (Leriche). A close study of the literature on visceral and referred pain seems to point in the direction that pathological pain is very often a sympathetic phenomenon.

If Dr. Kelly and other authors complain that their results regarding muscular lesions are inconsistent and the patients sometimes cannot be cured, it is, in my conviction, due to incorrect diagnosis. An extremely important point is the fact that the diagnosis of muscular lesions can by no means be based only on local tenderness or nodules. This is evident from Dr. Kelly's remark that "these situations" (namely, in the muscles) "are tender in the normal subject." In my experience a muscular lesion may be diagnosed only by the presence of "myalgic spots," the objective signs of which are described in the *British Journal of Physical Medicine* (1938, n.s. **1**, 302, and 1940, **3**, 50). A recent article (*Practitioner*, March, 1941, p. 167) describes the sites of the myalgic spots in all common myalgias of rheumatic, traumatic, and idiopathic origin. In addition it is to be noted that the myalgic spots are as a rule situated in anatomical points—namely, the origin, insertion, along the edge or along the course of a muscle. A second diagnostic point worth mentioning is the fact that the areas of referred pain complained of by patients are not arbitrary but seem to be governed by a law. Taking into consideration the sensory innervation of the skin in relation to spinal nerves—these so-called dermatomes—the pain is referred, at least approximately, to a skin area supplied by one or more spinal nerves which innervate the muscle producing it (*Lancet*, 1940, **2**, 326). In this way the area of pain as mapped out by the patient himself is a reliable guide in localizing the myalgic spots in the individual patient.

If proper care is given to these points and the sites of the muscular lesion are accurately located the results will, I am confident, be gratifying.—I am, etc.,

London, N.W.11, March 13. MICHAEL G. GOOD, M.D.

Analysis of Sulphonamides in Blood

SIR,—The successful therapeutic use of the sulphanilamide drugs frequently necessitates their accurate determination in the body fluids, especially the blood. The Bratton and Marshall method generally used for these analyses gives accurate results with sulphanilamide, slightly low results with sulphapyridine, and lower results with sulphathiazole. The mean analytical recovery from blood to which 5 mg. of sulphathiazole per 100 c.cm. was added is 89.03% if the blood is haemolysed in 1:20 dilution and 94.82% in 1:50 dilution. If, however, haemolysis is prevented by diluting the blood in 0.85% sodium chloride instead of 0.05% saponin or water, the recovery from 1:20 dilutions is increased to 93.88%, and the recovery from 1:50 dilutions to 99.95%. The analyses of blood from patients receiving sulphanilamide, sulphapyridine, or sulphathiazole show that the recovery of sulphanilamide from aqueous and saline filtrates is approximately equal. Saline filtrates of the blood from patients receiving sulphapyridine give a slightly higher recovery than aqueous filtrates. In the case of sulphathiazole saline filtrates give results significantly higher than aqueous filtrates. When aqueous and saline filtrate analyses of sulphathiazole are divided by the appropriate *in vitro* mean recovery values, the 1:20 dilution aqueous and saline filtrate results agree within 7 parts in 470, and the 1:50 aqueous and saline results within 7 parts in 650.

It is evident, therefore, that the complete haemolysis recommended by Marshall and his associates as essential to quantitative recovery makes no appreciable difference in the recovery of sulphanilamide and is to be avoided if precise analysis of sulphapyridine and especially of sulphathiazole is desired. Detailed data upon which these conclusions are based will appear in the *American Journal of Clinical Pathology*.—We are, etc.,

FRANK B. COOPER, M.S.
PAUL GROSS, M.D.
MARION LEWIS.

Pittsburgh, U.S.A., Feb. 11.

Agranulocytosis after Sulphapyridine

SIR,—I should like to report this case of agranulocytosis following only a short course of treatment with sulphapyridine.

A patient of mine, a male aged 26, was taken ill suddenly with severe sore throat, high temperature, and vomiting while on a visit to the country. He was seen by a local doctor. The following day he became worse and he was admitted to a local institution. Sulphapyridine was administered, apparently

with the idea that he was suffering from a severe infection, but there was no improvement in his condition. I went to see him and found that he recently had had a course of sulphapyridine for gonorrhoea. He had treatment for two weeks terminating one week before the onset of his acute present symptoms. Ever since he commenced the treatment he complained of weakness, pain in his limbs, and giddiness. When I saw him, four days after the onset of his acute condition, he looked extremely ill, emaciated, temperature 101°–103° F., with grunting respiration. He complained of sore throat, dysphagia, and weakness. The throat was covered with an extensive slough. I suggested a blood count, which revealed the extremely rare figure of one polymorph per c.mm. Blood transfusion was administered, but unfortunately ten days after the onset of his illness the case proved fatal.

Though this complication is well recognized, I feel that this case should be recorded in order to be on guard even when administering a short course of sulphapyridine.—I am, etc.,

London, E.1, Feb. 28. J. DYWIEN.

Scabies and Subnormal Intelligence

SIR,—I have read with interest the article on the incidence of scabies and its apparent dependence upon subnormal intelligence by Captain Geoffrey Hodgson in your issue of March 1 (p. 316). With experience as a former medical officer in the Navy and subsequently as medical superintendent of a colony of over 400 *male adult* mental defectives I may be permitted to make some observations. No doubt scabies does show greater frequency in those with low intelligence. Where good hygienic conditions are enforceable, as in the Services, infection is generally introduced to the community of men through the same source and by the same type of men as venereal diseases and pediculosis. During the period 1926–36, at all events in the Navy, this source was, both at home and abroad, the inferior types of brothels and shore-side lodging-houses. Only the less intelligent men expose themselves in such places.

From the last sixty new admissions of adult male mental defectives here, all rate-aided and many certified from magistrates' courts, three were found to have scabies. In each case the condition had become resistant to treatment, impervious to improved bodily hygiene, and had ceased to be a source of any discomfort or irritation. The three defectives concerned are fairly typical of the vagrant class and the petty criminal products of our lowest social stratum. It is likely, then, that Captain Hodgson's investigations will prove the relationship he sets forth. As a result, certain subnormal elements will be weeded out from the Forces as a source of impediment to efficiency. A situation will then arise whereby such elements will be returned to their homes to propagate (and their proclivities in this direction are recognized), while those elements from whom propagation should be encouraged are partially or wholly withheld from home facilities.

It would appear desirable, therefore, that the elements so weeded out should be divided into two groups representing two degrees of mental subnormality. Those who are graded "dull" should be retained in special labouring units of the Forces, while those whose intelligence coefficient is so low as to constitute certifiable mental deficiency should be so certified and, if returned to their homes, put under the visiting supervision of their local authorities, or, where possible, admitted to colony segregation. Failing such precautions the proportionate increase of sibs from defective stock would be given a flying start at a time when soundly parented children will be most desirable to the nation in its recovery from war.—I am, etc.,

March 7. J. JOHNSTON MASON, Medical Superintendent, Brentry Colony, Bristol.

Scabies Treatment in General Practice

SIR,—Captain Geoffrey Hodgson (March 1, p. 316) has shown by intelligence tests what one has always believed to be true—namely, that the patient with low-grade intelligence is the one most likely to get scabies. How does this knowledge affect treatment of scabies in general practice? The patients rarely have bathrooms in their houses, and "a large number of scabietic patients have dirty clothes, dirty skins, and dirty habits." They cannot all be sent to hospital, and because of their low standard of intelligence they can rarely be relied upon to follow instructions for treatment in their own homes. I believe treatment can best be done by the practitioner in his own surgery wth "rotenone" solution, as it takes only some five minutes compared with benzyl benzoate treatment, which takes half an hour (*Pharmaceutical Journal*, March 8, p. 79).

In the last three months I have during surgery hours painted with rotenone [which is a constituent of the plant derris] some fifty patients varying in age from 7 months to 75 years, and including three pregnant women. At the first consultation the patient is told to return after having a bath and to bring a clean towel. In front of a fire the patient is painted with a two-inch paint or varnish brush from neck to feet. The towel is used to cover a stool upon which the patient stands. A more important reason, however, for asking the patient to produce a clean towel is that this usually necessitates some clothes washing, which is all to the good. During the painting one has a chance of mentioning the need for frequent bathing, for clean clothing, and for changing of clothing. Possibly, as the one means of relieving the overworked general practitioner, the first-aid posts might be used as centres for treatment under suitable medical direction. I have been agreeably surprised at the good results and the unexpected co-operation of these patients. Many have brought other members of their family, bathed and with clean towel, without making any appointment, and I suggest that the local authorities might print a sheet of instructions which the practitioner could give to his scabietic patients.

I use rotenone 1% B.D.H. or 2% rotenone (sarevan, Evans) depending on how I feel regarding the case. The number of paintings required averages between three and four. There are a few return cases, probably reinfected, who, on instructions, come back immediately itching begins—always bathed and with clean towel—and who do not wait until a large area of the skin is affected. Patients get ready in an adjoining room while surgery is proceeding. For the patients who cannot pay the necessary repeated visits on *consecutive* days—for example, constant overtime munition workers—Evans Sons Lescher and Webb Ltd. made for me in December, 1940, a 2% rotenone ointment. This has been successful in the very few cases so far treated, and I hope to try this out further.—I am, etc.,

Newcastle-upon-Tyne, March 12. S. CALLER.

Medical Woman-power

SIR,—One reads week by week of the difficulty of allocating medical man-power for Service needs, but one looks in vain for mention of medical woman-power. In the last war medical women of my generation served the civil and military hospitals at home and abroad and helped in general practice. When hostilities ceased and men returned many of us married and retired from practice, and have spent the intervening years home-making and rearing families to take their places in the present struggle. Now we offer our services again only to find ourselves unwanted; a recent letter from the Central Medical War Committee informs one that "only a very small demand has been made for women practitioners." Last summer a Local Medical War Committee invited me to accept a post as medical officer to a hospital for evacuated children suffering from minor ailments—surely a suitable job for a medical mother—but the Government medical officer with whom rested the final appointment refused to employ me on account of my female sex.

It is not generally recognized that, the practice of medicine being a "reserved occupation," women doctors may not join the women's auxiliary services to the Army, Navy, and Air Force. The only medical work open to women, therefore, is to render assistance in general practice.

To me it seems wrong and foolish that this body of trained and experienced women accustomed to responsibility and comprising, moreover, about one-tenth of the entire medical profession should be side-tracked into the alley labelled "assistant for the duration," where useful work is being done, but work

which calls for these same qualities of physical endurance required by the men and women in the fighting and auxiliary services, and for no other reason than archaic sex prejudice in high places. I do not suggest that women should replace men as battalion medical officers, but there must be many administrative posts which could be filled by women, and certainly the demands of the members of the auxiliary services for women medical officers should be met. One anticipates with interest the report of the Committee on the Allocation of Medical Man-power which Mr. Brown has promised will be published shortly.—I am, etc.,

Tutbury, Staffs, March 3. MARY E. COCHRANE-DYET.

Vision Standards for Grading Recruits

SIR,—I have found the following details of such great service in saving time and worry that I thought other examiners might find them useful:

	R.E.	L.E.
Grade I Standard I: Unaided vision	6/6	6/6
	6/6	6/9
	6/9	6/6
Grade I Standard II: Unaided vision	6/9	6/12
	6/9	6/9
	6/12	6/6
	6/12	6/12
	6/12	6/9
	6/6	6/12
	6/6	6/18
	6/6	6/24
	6/6	6/36
Grade I Standard III: Unaided vision less than II but vision can be corrected to at least Standard II. If below 6/60 either eye—specialist. All men not placed in Standard I, II, III, refer to specialist.		
Grade I Standard IV: Unaided vision is less than II but vision cannot be corrected to Standards I or II but can be corrected to	at least 6/12 or 6/36	at least 6/36 6/12
	6/18	6/6
	6/24	6/6
	6/36	6/6
	6/9	6/18
	6/9	6/24
	6/9	6/36
	6/18	6/9
	6/24	6/9
	6/36	6/9
	6/12	6/18
	6/12	6/24
	6/12	6/36
	6/18	6/12
	6/24	6/12
	6/36	6/12

	R.E.	L.E.
Grade II (a) vision Standard V: Vision can be corrected to at least 6/24 in each eye.	6/18	6/18
	6/18	6/24
	6/24	6/18
	6/24	6/24
Grade II (a) vision Standard VI: Vision in one eye, with or without glasses, is not less than 6/12 and in the other is less than 6/36 with or without glasses, or has been practically lost.	6/6	6/60 or less
	6/9	6/60 or less
	6/12	6/60 or less
	6/60 or less	6/6
	6/60 or less	6/9
	6/60 or less	6/12
Grade IV Standard VII	6/18	6/36
	6/18	6/60 or less
	6/24	6/36
	6/24	6/60 or less
	6/36	6/18
	6/36	6/24
	6/36	6/36
	6/36	6/60 or less
	6/60 or less	6/18
	6/60 or less	6/24
	6/60 or less	6/36
	6/60 or less	6/60 or less

—I am, etc.,

West Kirby, Feb. 26. A. STANLEY PARKINSON.

"Give Us the Tools"

SIR,—"The general practitioner is the backbone of the country's health services" . . . we know that. We have heard it a thousand times, almost *ad nauseam*. The infantry is the backbone of the Army, but do we send our infantry into battle armed with bows and arrows? Somebody, the infantryman himself, would have something to say about that! Yet the general practitioner, having been trained in his school to the use of the technical developments of medicine which are in routine use, is sent out to fight in practice with a little leather bag! Oh yes! He can certainly obtain the advice and help required for his patients from the specialists and the hospitals, but he himself is barred from the fun of the game, and from exercising the skill and knowledge he acquired during his years of training and in his hospital appointments. In time, through lack of familiarity, the laboratory and the *x*-ray department become to his mind either awe-inspiring concerns which, like the slot machines, deliver ready-made diagnoses in return for hard cash, or they seem unnecessary and cumbersome complications of the modern machine-mad world. Some of his patients do not come back to him; some regard him as only fit to treat the minor disorders, not the real illnesses. Hence, after a few years of struggle and an increasing sense of frustration, many give it up, and really do become doctors only fit to treat the most minor disorders; and who can wonder at it?

The statement that clinical sense and not the laboratory aids reigns supreme in medicine is just reactionary nonsense *if* it implies that the aids to diagnosis are luxuries with which the "good practitioner" can dispense. The practitioner can perceive anaemia, discover glycosuria, hear a cough, record fever, and suspect cystitis. He can feel the irregular irregularity of the pulse, but he often cannot make the diagnosis without the aid of the laboratories and other special departments. But instead of having direct approach to these essentials he has to refer his patients to the specialist at an out-patient department at a hospital! The evils resulting from this are progressive. It is a serious thing if the backbone of the medical profession suffers from osteomalacia!

The system is bad, too, for the specialist, who has to deal with a glut of easily diagnosable disorders (given the necessary facilities), and cannot devote enough of his time to the few cases which really call for his skill. Anyone who has seen rows and rows of patients on hard benches at the hospitals will pity both the unfortunates sitting there and the physician or surgeon who, somehow or other, has got to "get through them." Finally it is bad for the patient, and medicine exists for the patient—not vice versa! He wastes time, and time is vitally important to the working people—so important that many will not report to their doctors or attend the hospitals until they are seriously ill, when curable disorder may have become incurable disease. Furthermore, it cannot be good psychologically for the patient to lose confidence in his doctor and go for treatment to the hospital.

The logical remedy for this state of affairs is apparent. The practitioner must have direct approach to the more common aids to diagnosis. I don't want to equip my infantryman with a tank: the specialist handles the tank, just as our specialists handle the cysto-, gastro-, and bronchoscopes, need calcium balances, and employ bone marrow investigations. But he must have a bayonet, a grenade, and a tommy-gun: he must have immediately available blood counts, blood ureas, blood sugars, sedimentation rates, sputum tests, microscopical and simple cultural examinations of the urine and faeces, and there must be an *x*-ray plant with a competent radiographer and radiologist, and possibly an electrocardiograph, at his service. And just as the Army has its Service corps, so should the practitioner enjoy the services of a trained nurse who could collect and examine specimens, take and record weights, prepare and sterilize instruments. The doctors should shut down their surgeries at their houses. They should be grouped together at a building where all these facilities are available. Here, too, would be their minor operation theatre, their mess-room, and their library. Co-operation and discussion would raise the standard of professional achievement, and those on the councils who deal with health problems could learn at first hand what the doctors need. The bad old times of "everyone for himself and his little leather bag" must go. And they will only go if the younger, more alive members of the profession, including medical students, residents, and the men in the Services, clamour and demand that they shall go. We must make a vociferous nuisance of ourselves that we may be given the tools with which to work. Only with the tools can we accomplish our task.—I am, etc.,

London, S.E.13, March 6. E. MONTUSCHI.

Mobile Unit in Action

SIR,—Your correspondence recently has revealed such a wide diversity of opinion regarding the utility of mobile first-aid units that I am prompted to contribute our experience.

Our particular unit has been called out to ten incidents, and has treated over fifty casualties—not many perhaps, but it is in the quality rather than the quantity of our work to date that its chief merit resides. Our casualties almost without exception have been trapped under debris for periods varying from one to nine hours. We have been able to improve their chances of survival by: (1) our facilities for shock and wound treatment while they were trapped and after they were rescued; (2) proper supervision of the final stage of the rescue operations, ensuring by accurate diagnosis and appropriate precautions that neither their injuries nor their shock were aggravated

by hasty removal or careless handling; (3) detaining them at our operational centre (a hall or a house adjacent to the incident) until they were sufficiently recovered from shock to undertake, in the case of hospital casualties, the ambulance journey—itself a shock-producing factor; and (4) a correct classification of the nature of their injuries, evacuating them accordingly to hospital, first-aid post, rest centre, or home.

This last function ensures for the casualty the appropriate treatment which his condition demands, and for the casualty services economy of both time and effort by an intelligent distribution of casualties among the various branches of the services. By "intelligent distribution" I mean that casualties are not, as a previous correspondent has remarked, "whisked off to hospitals without any attempt being made reasonably to segregate them." The same correspondent attributed this fault to "the hard-worked ambulance services." This is not so; it is due to the absence of any discriminating classification of casualties by the stretcher parties. Casualties when extricated are in what appears to be a ghastly condition: covered in dirt, dishevelled, and generally in a state which suggests one course of action—hospital. But often even a cursory examination at a mobile unit operational centre reveals that the injuries are negligible, and they respond very well to shock treatment. Stretcher parties working under black-out conditions are in no position to undertake such an examination. Further, by dispatching casualties to hospital immediately they are relieving themselves of any individual responsibility in the matter of "reasonably segregating" them. The result is to encumber the hospitals with casualties who could equally well be handled by first-aid posts.

One other important point about the work of our unit at incidents is that on several occasions one man has been assigned from the unit to act as incident doctor's deputy while the remainder of the personnel have been coping with casualties at the operational centre. This man's job is threefold. He works in conjunction with the rescue and stretcher parties, ensuring that: (*a*) no casualty is carelessly handled—that is, removed from the debris before a thorough examination of his condition has been made, and appropriate precautions taken not to aggravate his injuries; (*b*) as soon as a casualty is accessible, which often happens some time before he can be extricated, such shock treatment as is required is immediately provided and continuously maintained; (*c*) a check is kept on the number of casualties rescued in order that at any stage in the operations an accurate figure is available of the casualties still to be rescued. Concurrently with this strictly "mobile" work we have, since we were first established, been augmenting a fixed first-aid post, and have shared the work of treating the post's 240 casualties. Actually the personnel of each post has been trained to do the work of the other, so that they are largely interchangeable.

Naturally the scope of the unit's operations has been determined to a great extent by the severity of the air raids upon this borough, although we could possibly have been used more often. In view of the close approximation of our own average of casualties per incident to the general, it is reasonable to surmise that our experience is the rule rather than the exception—an impression which is reinforced by the account of Southwark's mobile work published in the *Journal* in January (p. 99). I should be interested to know how Southwark's mobile unit is called out; whose specific responsibility is it to send for the unit: wardens', stretcher parties', or Control? Our experience has, however, sufficed both to prove the real necessity for a unit and to testify to the ability of the unit to meet that need. True, some of our functions could equally well have been performed by a smaller unit. But on the other hand there are many boroughs, this included, which have no smaller units, and such experience as we have had has provided first-class training for our personnel to cope with graver emergencies. Again, these smaller units would have to be ancillary to the larger ones, since the larger units have their own definite role in the scheme of the casualty services; and as the larger units are, in our experience, quite successfully doing the job of the smaller ones there is little reason why they should not continue to do so. Any talk of replacing the larger units by smaller ones seems to betray a complete lack of appreciation of the facts. While, as I have admitted, some of the work of the larger units could be done by the smaller units, the reverse does not apply. The larger units, I repeat, have their own definite role in the casualty services—the role of mobile first-aid posts—and so long as the possibility exists that a borough may be "Coventrated," with hospitals and fixed first-aid posts put out of action, so long do the mobile units justify their existence as the first line of reserves of those services. In conclusion, I might add that the work of our unit has been granted no small measure of official recognition by the award of the George Medal to its nurse-in-charge, Sister M. F. Thomas, S.R.N. It was due largely to the work done by her in administering morphine and shock treatment "under the most hazardous conditions" to two trapped casualties that their lives were saved. Use these units more and they will save more lives.—I am, etc.,

F. J. HENLEY,
March 2. M.O., Woolwich Mobile Unit No. 1.

Delay in Treatment of Air-raid Casualties

SIR,—In the *Journal* of February 22 (p. 273) Dr. Margaret Ball and Mr. George Quist discuss a series of forty-three casualties, all apparently the result of one air raid and admitted to the Royal Free Hospital within a short space of time. Three of the patients later developed gas gangrene, and two of these had waited seven hours between admission and operation because of the large number of urgent theatre cases. The authors regard this delay as an important aetiological factor.

This instance of one hospital's receiving so many casualties that serious delay in treatment is inevitable is not an isolated one. It appears to be usual in London for ambulances to take all patients from one "incident" to one hospital, generally the nearest one, while another hospital less than a mile away may have no admissions. This policy of the London ambulance authorities is bound to result in delay in treatment. Many patients have multiple injuries, and they may require over an hour each in the operating theatre, with the result that the wounds dealt with at the end of the list have infection already established. In order to enable treatment to be undertaken at the earliest possible moment the casualties should be distributed to several hospitals and not all taken to the nearest.—I am, etc.,

NORMAN WHITE.
University College Hospital, London, W.C.1, March 11.

Shelter Policy

SIR,—With reference to Dr. Bushnell's letter (March 8, p. 381) on shelter policy, I would like to put forward certain considerations, although I feel doubtful whether even at this late hour any effective challenge will be made by a large body of the profession, or would have much effect if made. The great majority of medical men are not interested in shelters; they are too occupied with their own business. The official view would be that we are sufficiently represented by the Horder Committee, and those who disagree are usually accused of being some kind of "-ist." The B.M.A. has not moved in the matter in any representative manner, either centrally or locally; in any case there would be differences of opinion among its members.

As we have been told, the official policy of the Government, followed by local authorities and reflected in the Horder Committee (or at any rate stated by Lord Horder), is to encourage "dispersal" and its corollary "domestic shelters"; therefore it does not believe in the necessity or practicability of bomb-proof shelters. The stress laid on fire-fighting, and the urging of the population to stay in their houses, protected by Andersons, Morrisons, and cellars, is said to enhance morale. That mothers, children, and the aged should be exposed to the risk of being killed because this is good for morale may sound fantastic, but seems a logical conclusion from the premises—even if they are all evacuated, for there are few shelters in country districts.

After the November raids many hundreds if not thousands of the population in heavily bombed areas evacuated themselves nightly, often on foot, either to shelters in the suburbs (otherwise unused) or to fields and hills miles from this city. The morale of these people is splendid, let there be no mistake about that; but prolonged, intensive raids are more than flesh and blood will stand. Yet these people are being provided with small brick surface shelters in backyards. In fact, policy appears to be dictated by doctrinaire theory rather than by

observing what happens or taking into account the psychological needs of the situation.

I am not saying that the official policy may not be right, but merely implying my own views or prejudices in the matter and stating certain facts of observation in one locality. There is always a certain amount of "projection"—of personal instinctive and acquired reactions and sentiments—in whatever policy anyone holds, but the still small voice of reason can prevail—if re-echoed long and loudly. Therefore one can but hope that medical men who are not satisfied will join in putting forward the physiological and psychological needs of the population, with insistency, to the authorities; as you, Sir, and Sir John Orr have suggested is our duty.—I am, etc.,

Birmingham, March 10. CHARLES BURNS.

Optimum Calcium Requirements

SIR,—Miss Leitch has challenged our contention that arteriosclerosis is prevalent among the affluent classes. Here is our reference: *Arteriosclerosis*, by Edmund V. Cowdry, Macmillan, 1933, p. 226. That calcium affects renal function is an established fact apart from the formula. Our rabbit experiments comprising considerable material will be published later, and more details will be found in the report of a parallel investigation due to appear somewhere else. The idea that people under low calcium intake may suffer from some occult disease which nobody can detect is too fantastic to deserve a moment's consideration.

Large retention of calcium is a peculiarity of middle age. Similar results were obtained by us with regard to protein retention. Our table consists of averages, and individual high faecal calcium was submerged in the averages. But the main reason for a low faecal calcium is a large retention. Only when calcium is no longer absorbed does a large percentage pass via the faeces. We have had a great deal of experience of this type of work, as our various publications show. Children and pregnant women require other items of food as much as calcium, which can only be supplied by milk. The latter cannot be replaced by bread calcium. The fortified loaf concerns only the adult population, which requires but little calcium.

Now to the core of the problem. It is quite impossible for a person to remain in a negative calcium balance permanently without exhibiting definite evidence of calcium deficiency. It is certain that the whole adult population of this country who do not exhibit calcium deficiency are in calcium balance whatever their intake may be. Calcium minima obtained by experiment depend to an important extent upon the amount of calcium the subject is in the habit of taking. It is very likely that when the calcium intake is low some kind of conserving mechanism becomes operative. True minima of calcium requirement are unknown. These can only be obtained by prolonged clinical observation. As far as optimum requirement is concerned, an amount which fills the reservoirs and supplies the daily needs will, when saturation is attained, supply more than the needs, and a part of the surplus will leave via the kidneys. The latter organs will therefore work unnecessarily and calcium will be circulated in the blood, already saturated—a factor which favours deposits.

The vital problem arises whether a calcium intake which just meets requirements and does little towards filling the reservoirs, or one which fills the reservoirs to overflowing, or one which is between the two extremes, is the ideal. No data whatever are available to judge which is the best, and the choice of one or the other is merely arbitrary. Only prolonged clinical observation can show which is the ideal. We find a similar phenomenon with regard to the fat reservoirs. Clinical experience has taught us that the average expectation of life of those who fill these reservoirs to full capacity is much below that of those who consume only sufficient to cover the needs.

The investigator does not know the real minima. He does not know whether the amount of calcium necessary to fill the whole or part of the reservoirs or which leaves them empty is the ideal. He does not know whether the marginal safety calcium is necessary at all, for there may be as much danger in too much as too little calcium, and the figure of 50% of marginal safety is purely arbitrary. It will be seen that when these experts in language of the exact sciences tell us of the exact ideal calcium requirement per lb. weight they deceive themselves and deceive us. Theirs is a dangerous form of ignorance, for they do not know that they are ignorant. The requirement figure is artificial, unsupported by any evidence, and to estimate calcium intake by money income is not a method to be used in exact science. No direct experimental evidence whatever is available that a section of the community is under a permanent negative calcium balance. A number of unknown quantities are strung together and a heavy superstructure is built on this insecure foundation. It is sheer lunacy that such a far-reaching scheme as entailed in the Government's proposals should be set up on such a flimsy basis. The type of laboratory work under review, if correlated with clinical findings, has a limited value. If not checked by clinical observation it becomes a fantasy without value. In my view it is a grave public scandal that millions of perfectly normal, perfectly healthy adults should be compelled to consume extra doses of such a potent substance as calcium for no reason whatever. A large number of middle-aged people who exhibit evidence of kidney damage, etc., would suffer injury from this extra chalk. In my view it would be discreditable to our profession if we tolerated these proposals; and I appeal earnestly to the Medical Research Council to pause before committing themselves to this criminal folly.

I want from your correspondents a simple answer to a simple question: What is the percentage of the adult population who suffer from calcium deficiency which can be detected by any known method, clinically or in the post-mortem room? The proposal could only be justified if a considerable number of the adult community show evidence of deficiency.

Sir, you are aware that the Government proposals have nothing to do with this war. They have been proclaimed as a great reform which would make us all healthier. In my view the added calcium can serve no useful purpose, for it cannot replace milk.—I am, etc.,

Liverpool, March 1 I. HARRIS.

*** In a leading article on February 22 (p. 281) we made it plain that in our opinion the proposed addition of calcium to flour in wartime was a sound nutritional measure. We must disagree again with Dr. Harris, and suggest to him that a large retention of calcium is not a peculiarity of middle age, and that there is no proof at all that "a large number of middle-aged people who exhibit evidence of kidney damage, etc., would suffer injury from this extra chalk." Dr. Harris states: "Children and pregnant women require other items of food as much as calcium, which can only be supplied by milk. The latter cannot be replaced by bread calcium." If this sentence means that milk calcium cannot be replaced by bread calcium, it is wrong. If it is taken to mean that milk itself cannot be replaced by bread calcium, we would point out that no one has ever suggested the contrary. In view of the malnutrition which has existed among the poorer sections of the population, and which war conditions may easily aggravate, we find entirely misleading Dr. Harris's statement that "it is a grave public scandal that millions of perfectly normal, perfectly healthy adults should be compelled to consume extra doses of such a potent substance as calcium for no reason whatever."—ED., *B.M.J.*

Invalid Diet and the Egg Shortage

SIR,—I am concerned about the country's production, or rather elimination, of that outstanding article of an invalid's diet—the egg. Since meat for beef tea is difficult to obtain, though the meat ration may be sufficient; since fruit is scarce and fish prohibitive; since milk prices have turned that commodity into a luxury, should not some encouragement be given to egg production? While large mixed grills are still obtainable in London restaurants the invalids and convalescents in home surroundings have a thin time.

Eggs cannot be imported to any extent. Poultry stocks through lack of feeding-stuffs have to be reduced to one-sixth. Poultry farmers who have specialized in the economic production of eggs and table fowls go out of business. A reduction from 3,000 hens to 500 ensures this. Locally raised poultry food must to some extent be in the hands of mixed farmers

(as opposed to poultry specialists), who will eventually produce most of the eggs available in the country on non-economic lines. How many of these will filter through to invalids, hospitals, or even to the town-dwelling working man, who might welcome a fried egg on his meatless day, this year will show. In the meantime, will not our profession show some mild interest in the fate of the hard-working pullet?—I am, etc.,

Hexham, March 10. RICHARD BELL.

Supplementing the Dietary

SIR,—In the *Journal* of March 8 (p. 381) Dr. Joseph Jones writes especially with regard to the shortage of protein. Is there any reason why separated milk should not be used? A cheese used to be made from it in Dorset which was sold at the very low price of 3d. a pound. In the form of dried separated milk its use was strongly advocated by Mr. Eustace Miles. Casein is the only, or an important, constituent of various well-known advertised preparations. Its value is equal to that of any form of lean meat, white fish, or fowl. It is used unfortunately in industry for the manufacture of various articles which simulate those made from pottery or bone; its use as a food would seem much more important.—I am, etc.,

Bournemouth, March 10. F. C. BOTTOMLEY.

Natural Bran in the Treatment of Constipation

SIR,—Dr. Parkes Weber points out in your issue of February 15 (p. 252) that the Government's prohibition of the manufacture of prepared bran will cause hardship to those sections of the community who depend on this product for the prevention of constipation. The following may therefore be of interest.

I have used natural unprepared bran in the treatment of constipation in the Royal Navy for at least ten years. It has invariably been successful, provided the dose has been maintained at an adequate level. Indeed, by the laws of Nature it *must* be successful. I can only say, as regards the reported resistance of "spastic" cases of constipation to cellulose-stimulation, that I have not found any such cases when using natural bran: any failure has always been due to inadequate or irregular dosage.

The dosage varies (*a*) with the individual, and (*b*) with the amount of cellulose taken in the food. As regards item (*a*), it may be noted that the more northern the race the less cellulose is taken in the food, owing to the progressive diminution in plant life that occurs, and vice versa. The Eskimo, for example, takes almost no cellulose at all under natural conditions, whereas the African native takes a vast quantity. It follows that there is scope for great differences in the cellulose requirements of different individuals. Thus, a fair-complexioned individual in this country, representing some northern (e.g., Viking) race, would normally require less cellulose than a dark individual representing a more southern (e.g., Latin) race. As regards item (*b*), it is clear that the more cellulose taken in the food (e.g., fruit and vegetables) the less is required to be made up by the taking of bran.

In actual practice the dosage of natural bran varies from a teaspoonful to two tablespoonfuls before each meal, but the larger dose is seldom required except in bed patients. It is essential to *start* with the larger dose and reduce it, as results occur, until the correct maintenance dose is established. Regularity of dosage is fully as important as the quantity of dosage. The reason for taking it before each meal is that proportionately less food is then eaten during the meal, and so no indigestion results; but if the appetite was fully satisfied by a meal and then a large dose of bran was taken, overloading of the stomach, with attendant discomfort, might be expected. The bran may be taken in soup or with milk, or be just washed down in a glass of water. It is unexciting to take but not unpleasant. Bran is, of course, prophylactic against constipation: it is useless for an occasional bout of this trouble. As it takes at least forty-eight hours, and sometimes ninety-six, to have any effect, it is desirable to start off a case of established constipation with an enema, and possibly another forty-eight hours later: a third is never required.

The great advantage of natural bran is the low cost (a few pence a month). People who are reasonably well off can nearly always avoid constipation by taking an *adequate* amount of fresh fruit and vegetables, but this knowledge is of little comfort to the indigent poor. For them unprepared bran is the sole natural aperient they can afford to buy. Natural bran is readily procurable. In H.M. ships the canteen can always carry a stock of it. On shore corn-chandlers stock it, and bakers can easily order it.

The question may be asked whether there is any risk of contracting actinomycosis from natural bran. The answer is definitely "No." The fungi found on wheat bear no more relation to the superficially similar *Streptothrix actinomyces* than do the bacilli of Timothy grass to the superficially similar tubercle bacillus. Natural bran is as safe to eat as any other raw vegetable or fruit.—I am, etc.,

Feb. 26. T. L. CLEAVE, Surgeon Commander, R.N.

Acute Abdominal Pain after Opium Medication

SIR,—I have been most interested in Dr. J. B. Williamson's letter (February 8, p. 215). It recalled to me some experiences which I recorded in a short memorandum in your *Journal* in 1917 (**1**, 72). The record is as follows.

Four cases of severe abdominal pains following large medicinal doses of opium or drugs containing its derivatives have recently come under my observation. In each instance the symptoms were such as might easily lead the observer to believe at first sight that he was confronted with an abdominal condition requiring surgical interference.

Case 1 was of a man aged 25 suffering from toothache, who took 1 grain of morphine hydrochloride by the mouth. Two hours after the administration he awoke with violent abdominal pains coming on in spasms. He was sent to hospital as possibly a case of perforated duodenal ulcer.

Case 2 was of a man aged 37 suffering from influenza. During the course of an evening he took five tablets of 5 grains each of Dover's powder, which contains 10% of opium. The patient awoke about two hours after the last dose with violent abdominal pain.

Case 3, a man aged 23, was admitted to hospital suffering from an injury to the lower part of one thigh; he complained of great pain and was given a hypodermic injection of heroin, 1/6 grain. A quarter of an hour afterwards he began to cry out with intense pain in the upper part of the abdomen. He was apparently suffering very much, as he began to writhe about, forgetting for the time being the injury to his thigh. He continued thus for half an hour, when he was given another dose of heroin, 1/6 grain, which apparently afforded no relief and the dose was repeated: after this he became quiet and ceased to complain.

Case 4 was of a man aged 24 suffering from nasal catarrh and bronchitis, who took 2 oz. of Brompton mixture, which contains liquor morphinae hydrochlor. Between two and three hours later he was awakened by severe cramp-like pains in the region of the stomach.

These cases resemble each other very closely in their symptoms: spasms of gripping pain in the epigastric and left hypochondriac regions, coming on at intervals of a few minutes, lasting about a quarter of an hour, and so severe as to double the patient up and cause him to groan. The symptoms in the first two cases lasted for about an hour and then passed off completely without treatment other than hot bottles. The third case at the end of an hour was also free from pain, but by that time he had received in all 1/2 grain of heroin hypodermically, and it is likely that the last injection placed him so deeply under the influence of the drug as to relieve him of the consciousness of pain. Case 4 suffered for about half an hour, when he was given 1/120 grain of atropine hypodermically, after which he got almost immediate relief. In none of the cases was there any vomiting or nausea. The pupils in each instance indicated by their contraction that probably opium had been taken, and on inspecting the abdominal wall the upper part was distinctly rigid and respirations were short. In one case both recti stood out very prominently. The patients resented palpation of the abdomen, as it appeared to tend to start the spasms. On inquiring into the histories of the individual cases, none of them had

previously had any condition resembling that described, and subsequent to the attacks passing off all seemed perfectly well.

It would be interesting to know if other practitioners have had cases of this kind, as these seem to demonstrate an action of the drug which is not generally recognized. Inquiry among my medical friends reveals only one instance of acquaintance with this peculiarity of the action of opium, and in this case a well-known surgeon had a personal experience of these unpleasant symptoms. Opium causes convulsions in cats and amphibians, and a veterinary friend informs me that a severe colic is known on occasion to follow administration of morphine in horses.

In the late Sir Lauder Brunton's *Textbook of Pharmacology, Therapeutics, and Materia Medica* the fact that opium in certain conditions stimulates intestinal peristalsis is noted. He seems to have used it occasionally in very small doses, one drop or even half a drop of tincture of opium, in certain forms of constipation—for example, that caused reflexly by ovarian irritation.—I am, etc.,

London, March 12. H. P. WINSBURY-WHITE.

Operation for Acute Appendicitis

SIR,—Some years ago I saw Prof. Nordman at the Martin Luthers Krankenhaus, Berlin, use a method of operating for acute appendicitis that I have not so far seen in England. So far I have used it in some twenty-five cases. The incision is placed a fingerbreadth above and parallel to the outer half of Poupart's ligament—two to three inches long according to the amount of adipose tissue present. The external oblique is divided in the direction of its fibres and retracted, and a small intermuscular septum in the internal oblique running downwards and inwards from the anterior superior iliac spine is seen along this. As in McBurney's incision the fibres of the internal oblique and transversalis are separated by blunt dissection and the peritoneum opened.

In about one-quarter of the cases the appendix presents, in one half the colon. The anterior longitudinal band is seized with smooth forceps and gently drawn upwards until the root of the appendix is seen; this is seized with strong forceps and the appendix delivered. If the omentum presents it is thrown upwards. The fingers do not have to be introduced into the wound at all. The skin wound does not stretch. All my cases have been early ones without marked adhesions, but I seem to remember that some years ago Sir Hamilton Ballance advocated a similar incision but "muscle cutting" as the best approach for acute appendicitis.

A point about acute appendicitis that I cannot remember having seen noticed is the change in position of the appendix as the inflammation progresses: the swelling and shortening of the mesentery in the region of the ileo-colic artery drawing the caecum upwards and inwards. Dr. Crabtree of Nelson tells me that in some 6,000 routine opaque gastro-intestinal examinations he has not found the caecum elsewhere than in the iliac fossa, which seems to be the normal dwelling place.—I am, etc.,

Nelson, March 5. OWEN WILSON.

Malignant Measles?

SIR,—In reply to Dr. Audrey Baker's letter (March 8, p. 380) dealing with a so-called case of malignant measles, I am not clear on what grounds such a diagnosis was justified. The case quoted was undoubtedly an unusual one, but I would suggest that the more correct diagnosis was one of suprarenal haemorrhage. This interesting condition occasionally sets in during the first year of life as part of a rapidly fatal illness. The symptoms set in suddenly with fever and vomiting, and scattered purpuric spots quickly follow. Death usually occurs within twenty-four hours. I met such a case a few months ago, and post-mortem examination confirmed the diagnosis.

I notice Dr. Baker makes no mention of Koplik's spots, exposure to infection, or, in fact, of any of the usual symptoms associated with measles, and, in consequence, I venture to suggest that her case was one of haemorrhage into the suprarenals.—I am, etc.,

Aylesford, March 13. GEOFFREY P. GOODWIN.

SIR,—Though the case described by Dr. Audrey Baker (March 8, p. 380) was clearly both malignant and "black," it is a mistake to regard "blackness" as a sign of malignancy or malignancy as a cause of "blackness." I have met a number of cases of "black" (haemorrhagic) measles, but not one of the patients has died or shown any sign of malignancy, and some of the cases have run a decidedly mild course. A friend tells me that "black" measles was quite common in Ireland fifty years ago, and that the fatality was so high that "black" was regarded as almost synonymous with malignant, but that in those days the children were commonly poor, half-starved little creatures, and this might account for the high fatality and perhaps also for the prevalent "blackness." The patients in my own cases were all well nourished and generally in good condition, which accounts for the absence of fatality but leaves the pathology of the blackness an open question. At any rate, the terms should not be employed as though they meant the same thing.—I am, etc.,

Ambleside, March 13. J. PRICE WILLIAMS.

Continuous Pentothal Anaesthesia

SIR,—One of the questions most frequently asked by practitioners who are desirous of employing continuous pentothal anaesthesia is: "What are the difficulties that may occur?" So far as I can judge these have not been explained in detail, and having employed continuous pentothal in over 500 cases, many of which were battle casualties, I think that I have encountered most of the difficulties.

1. Fibrillation of Muscles.—In most cases only the masseter is affected, but it may extend all over the body. It is very similar to ether tremor, and disappears with the introduction of more pentothal.

2. Sudden Muscular Contraction.—This may occur spontaneously or be due to surgical stimuli. The commonest muscles to contract are the pronator quadratus and pronator radii teres, thereby adding to the difficulty of the injection. Very occasionally a rhythmical contraction may occur; one patient kept flexing and extending a knee-joint after 40 c.cm. of a 5% solution (2 grammes) had been given.

3. Very Shallow Breathing accompanied by Cyanosis.—This is very common, but is quickly remedied by a few breaths of carbogen under slight pressure. I think that continuous pentothal should not be employed by those inexperienced in its technique unless CO_2 and O_2 is available.

4. Persistent Coughing.—This has occurred in a few cases but is usually overcome by increasing the dosage. One patient was given 50 c.cm. of a 5% solution (2.5 grammes) and even then the coughing was not satisfactorily controlled. This is most unusual.

5. Severe Laryngeal Spasm.—I have had only three cases of this condition, all of which were preceded by coughing. The operation in each case was for haemorrhoids. These cases were rather alarming, but eventually responded to O_2 under considerable pressure.

6. As patients who have had large doses sleep for a considerable time afterwards, it is advisable to insert an airway before they return to the ward.

The post-anaesthetic complications are: (1) Numbness of the skin of the arm; this is transient and is due to the introduction of pentothal into the tissues. (2) Bruising of the arm. (3) Restlessness; this occurs only when under 15 c.cm. of a 5% solution has been given. (4) Thrombosis of the vein; I have had only one case of this condition.

In conclusion, these difficulties, with the exception of shallow breathing, are uncommon, and I hope will not deter those who are desirous of employing this very valuable and pleasant anaesthetic.—I am, etc.,

Feb. 14. R. HASTINGS MOORE.

Pentothal Sodium in Acute Hysteria

SIR,—I have had an opportunity of confirming Frankel's experiment mentioned in the *Journal* of January 6, 1940 (p. 14) on the use of evipan in a case of loss of memory, and agree that intravenous barbiturate is useful in dramatically relieving an acute hysterical state of mind. In this case, too,

there was "something desperate in the history which it was essential for the patient's peace of mind that he should forget."

A soldier was brought to hospital by the guard. He had suddenly become unruly and had thrown his money far and wide. There was complete "blocking" and no response to direct questioning; meanwhile the patient continued in a state of increased psychomotor activity with low moanings and rapid respirations. Careful physical examination ruled out signs of organic disease, while the fluttering eyelids were so typical of hysteria that the upward rolling of the eyeballs which occurred when an attempt was made to see the pupils merely served to confirm this diagnosis. In short, the picture was typical of the hysteric who lives from hand to mouth and who obtains a bed at hospital by defeating the young casualty officer with practised ease, and to whom the hysterical attack is an accomplishment as well as a profession. By giving 4 c.cm. of pentothal sodium solution (1 gramme in 20 c.cm. aq. dest.) sleep of an hour's duration was produced, and when seen three hours later the patient was rational and wished to rejoin his unit. It was now discovered that this man had been ordered over-seas immediately preceding the acute symptoms, hence the mental conflict. The sedative action of the barbiturate relieved these inhibitions, and the patient was now able to appreciate that malingering meant a court martial, so all idea of disobeying orders was given up forthwith.—I am, etc.,

J. A. MAXWELL CAMERON,
Capt., I.M.S.

Karachi, Jan. 15.

Nurse Anaesthetists

SIR,—The correspondence on nurse anaesthetists is very interesting, but from a surgeon's pont of view not very convincing.

If anaesthetists wish their calling to be considered essential, then they must be prepared to attend and administer to every routine hospital surgical operation list. This, in my experience, with few exceptions they seldom do. Often a 'phone message arrives to indicate that they cannot attend, and only occasionally do they arrange for an adequate deputy. Usually a house-physician or a house-surgeon, often newly qualified, has to give the anaesthetic, and only if an intratracheal anaesthetic is necessary must the operation be postponed. A surgeon never allows a house-surgeon to do an operation until he has been trained and tested, yet hospital anaesthetists often leave operation lists for untrained resident staff. Personally, I consider that a trained intelligent nurse is quite capable of giving an ordinary good general anaesthetic, and I have occasionally had to operate with a nurse giving the anaesthetic and with complete satisfaction. I consider that a trained anaesthetist is a luxury for a surgeon, but a newly qualified doctor is often a sore trial, and too often specialist anaesthetists leave us none other but these as deputies. In many hospitals I think that a trained nurse anaesthetist would be of great value, and the correspondence in the *Journal* to the contrary has not convinced me. I think that Cambridge is to be congratulated for raising the subject.—I am, etc.,

F. MACG. LOUGHNANE.

London, W.1, March 10.

A. C. Drogendijk (*Brux. méd.*, 1940, **20**, 617) describes the various methods employed for preventing the occurrence of post-vaccinal encephalitis—namely, vaccination within the first two months of life, while the child still retains some passive immunity transmitted from the mother, which it loses later; choice of a certain season of the year, although statistics do not prove that the risk of encephalitis is greater at one season than at another; the use of a very diluted lymph (cases, however, have occurred after a 1 in 100 dilution); and reduction in the number of insertions. Although this reduction cannot be shown to be of much effect, there is no need for multiple scarifications if one is enough. The other prophylactic methods consist in the employment of fractional vaccination, intracutaneous or subcutaneous vaccination, vaccination of the mother during pregnancy or lactation, injection of an anti-vaccinial serum, inoculation of a killed vaccine, and modification in the mode of preparation of the vaccine. None of these methods, however, has proved to be absolutely efficacious.

Obituary

T. A. ROSS, M.D., F.R.C.P.

We regret to announce the sudden death at St. John's House, Smith Square, Westminster, of Dr. Thomas Arthur Ross, who was the first director of the Cassel Hospital and held that post for fifteen years.

He was born in Edinburgh in 1875, the son of Thomas Ross, LL.D., and after schooldays at the Edinburgh Academy entered as a medical student at the university and graduated M.B., C.M. in 1897. He proceeded M.D. in 1901 after serving as resident physician and resident surgeon at the Royal Infirmary. He was then appointed physician to the Royal National Hospital for Consumption at Ventnor, where he was in general practice for sixteen years. When the Cassel Hospital for Functional Nervous Disorders opened at Swaylands, Penshurst, in 1919 Dr. Ross became its medical director and thenceforward devoted himself entirely to the neuroses and psychotherapy. He was elected a Fellow of the Royal College of Physicians of Edinburgh in 1919 and a Fellow of the Royal College of Physicians of London in 1933 after taking the Membership in 1926. He wrote three books: *The Common Neuroses and their Treatment by Psychotherapy*, which reached a second edition four years ago; *An Enquiry into Prognosis in the Neuroses*; and an *Introduction to Analytical Psychotherapy*. In the central work of the British Medical Association, which he had joined in 1898, Dr. Ross served on three special committees: the Committee for Research in Mental Diseases, the Psycho-Analysis Committee, and the Mental Health Committee. He was twice married and had two children: a son who died whilst still a medical student, and a daughter, Dr. Jean Durrant, who is an assistant medical officer at the Maudsley Hospital.

Sir ARTHUR HURST writes:

During the seventeen years he was in general practice at Ventnor Ross was greatly interested in the treatment of patients suffering from functional nervous disorders, many of whom were sent to him by Victor Horsley, who was one of the few people in those days who was not merely bored with his neurotic patients. At first Ross treated them by the Weir-Mitchell method, which was at that time almost universally used for all kinds of neuroses. The patients were kept in bed, isolated from their friends, over-fed, and massaged. For some years he met with great success. He then gradually lost his early enthusiasm for the treatment, and as he did so his results deteriorated. He soon realized that the change was not in the treatment, which remained unaltered, nor in the patients, but in himself. He had slowly come to the conclusion that exhaustion was not the sole cause of the neuroses and that his results had been largely due to his belief in the treatment. By 1914 he had learnt the lesson that the cures were the result of faith and hope, and that the ideal psychotherapy is to teach the patients how they can reacquire faith in themselves. He acknowledged that there were cases where psycho-analysis was required, but there was a large majority in which better results could be obtained by simple methods. This conclusion did not in any way diminish his appreciation of Freud's contributions to our knowledge of the neuroses, although it was to the encouragement and advice he received from Henry Head and the writings of Dejerine that he felt chiefly indebted for his success as a psychotherapist. "The Freudians long ago gave up the general physician as a hopeless person who is unteachable, and it seems desirable," he wrote, "that those of us who are in the first instance physicians and only in the second psychotherapists should not give up the Freudians." It was for this reason that he published in 1932 his *Introduction to Analytical*

Psychology, in which he emphasized what seemed to him to be good in analysis without dwelling too much on the bad.

From 1917 to 1919 Ross was attached to the Springfield war neurosis hospital. In 1919 Sir Ernest Cassel decided to give a large sum of money for the advancement of some pioneer work in medicine. He asked for three schemes from which to choose. He adopted Sir Maurice Craig's suggestion of an institute for the treatment of neuroses in patients of moderate means, and the Cassel Hospital at Swaylands, Penshurst, thus came into being. Craig had no doubts from what he knew of Ross that he was the ideal man to be the first medical director of the new hospital, and the future was to show how wisely he had chosen. After a preliminary visit to a number of American clinics Ross began work at this, the first hospital of the kind to be established in Great Britain. His success during the fifteen years he was medical director was remarkable, as innumerable grateful patients and their doctors can testify. His annual summary of the year's work and follow-up of all of his 1,200 old patients was later summarized in 1936 in his *Enquiry into Prognosis in the Neuroses*. This was a most valuable contribution to the literature of psychotherapy and the first and most complete work of the kind to be published. He found that 45% of his patients were well and 25% improved after one year, 40% after three years, and 34% after five years—an unexpectedly good result.

Ross believed that the great bulk of functional nervous disorders can be treated successfully by the general practitioner, and it was in this belief that he wrote his great work on *Common Neuroses*, a worthy sequel to Dejerine's *Névroses et Psychonévroses*. Since its publication in 1923 I have always told students that whatever textbook on medicine they like to read they must supplement it by reading Ross's *Common Neuroses* if they aspire to be successful practitioners. As Ross pointed out, if the general practitioner is to undertake psychotherapy his treatment must be simple and reasonably short, and he will find that it is rarely necessary to refer a patient to an expert psychotherapist for more prolonged and specialized treatment. Ross was convinced that general practice or general medicine was the proper approach to specialized psychotherapy, and he deplored the tendency of the teaching hospitals to choose alienists as their instructors in the subject. He equally deplored the modern tendency for a newly qualified medical student with no postgraduate medical training and no knowledge of the world to set himself up as a specialist in psychotherapy with no broader training and no sounder foundation than a course of instruction at a psychotherapeutic institute.

Ross was a charming companion and it required a very short time in his presence to make one understand how quickly he was able to gain the confidence of his patients and to help them to regain their mental health. All who knew him will agree with Sir Farquhar Buzzard that "his success, both as a doctor and a friend, was due to his personality. Behind the screen of a charming gentleness and modesty of demeanour there lay solid moral courage and transparent honesty of purpose, qualities which even he could not disguise by an inimitable and pawky sense of humour."

On February 19 the death occurred at Ashburton, South Devon, of Dr. THOMAS OATES HALLIWELL at the age of 70. He had been a member of the British Medical Association for thirty-four years. Trained at St. Thomas's Hospital, Dr. Halliwell qualified M.R.C.S., L.R.C.P. in 1894. He practised in his native town of Dewsbury, Yorks, for some years. In 1906 he gained the D.P.H. at Leeds and became medical officer of health and school medical officer for Dewsbury, where he built up the public health service. A serious illness caused him to resign this appointment, but happily he recovered and entered the local government service as resident medical officer at the Staincliffe Poor Law Institution, which later became the Staincliffe County Hospital under the West Riding County Council. It was at this post (writes V. R.), which he held till his retirement some six years ago, that Dr. Halliwell's all-round abilities were displayed. As well as being an administrator he was surgeon, physician, and gynaecologist, a type of doctor which has become all too rare. He took great interest in training nurses for the C.M.B., for which he acted as examiner latterly. A man of courtesy and charm combined with a Yorkshire straightforwardness, Halliwell will be missed by his many friends. Those who had the privilege of knowing him in his family circle will remember the culture and hospitality of his home. He was a collector of old china and antique furniture. He took a keen interest in freemasonry. He leaves a widow and daughter. His son, Eric Oates Halliwell, M.R.C.P., practises in Yorkshire.

DR. JOHN ADOLPHUS KENNEDY of Portstewart, Co. Derry, died at Hopefield Cottage Hospital, Portrush, Co. Antrim, on January 4, aged 68. He graduated B.A., M.B., B.Ch. at Trinity College, Dublin, in 1899, and soon after was appointed dispensary medical officer for Portstewart, a post which he held until his death. He proceeded to the M.D. degree in 1904. A member of the North-East Ulster Division of the British Medical Association, Dr. Kennedy was very popular with his medical colleagues, and was held in high esteem by the residents of the town. He was Senior Elder of Portstewart Presbyterian Church and was a member of the Masonic Order.

Universities and Colleges

UNIVERSITY OF CAMBRIDGE

On the recommendation of the Faculty Board of Medicine the Senate resolved on March 14 that Grace 6 of October 20, 1939, shall not apply to medical students whose first term of residence is the Michaelmas term of 1942 or a later term. The Grace in question puts into abeyance, until further order, Regulation 8 (*c*) for the M.B., B.Chir. degrees, which requires a candidate for the Final M.B. examination to have obtained honours, or to have attained the honours standard, in the Natural Sciences Tripos.

The following are the dates of Congregations to the end of the Easter term: Saturday, April 26, Friday, May 9, Saturday, May 24, and Friday, June 6, at 2 p.m. There will also be general admissions on Saturday, June 14, at 11 a.m., and on Tuesday, June 17, at 11 a.m. and 2 p.m.

At a Congregation held on March 14 the following medical and surgical degrees were conferred:

M.D.—*C. E. D. H. Goodhart, C. G. Batty-Smith, G. S. W. Organe.

M.CHIR.—*R. C. F. Catterall, *G. Blackburn, *J. S. Ellis.

M.B., B.CHIR.—J. G. Craddock.

* By proxy.

UNIVERSITY OF LONDON

Retirement of Principal

The period for which Mr. H. L. Eason, M.D., M.S., F.R.C.S., was appointed as Principal of the University ends on September 30, and the Senate has decided that the post shall not for the present be filled. Mr. Eason has held the office of Principal since July, 1937, having been a member of the Senate from 1911 and Vice-Chancellor from 1935. He is the President of the General Medical Council, on which body he has represented the University since 1925. The Senate, with the concurrence of the Court, has appointed Mr. Harold Claughton as Acting Principal from October 1.

Postponement of Elections by Convocation

Under an Emergency Statute no elections by Convocation of persons to be members of the Senate will be held in 1941, and those persons who are due to retire on the second Tuesday in May of this year will continue to be members of the Senate until the second Tuesday in May, 1942. Under another Emergency Statute no elections to the offices of Chairman and Deputy Chairman of Convocation are to be conducted before March 1, 1942, and the present holders of these offices will continue in office until May 10, 1942.

ROYAL COLLEGE OF SURGEONS OF ENGLAND

At a meeting of the Council of the Royal College of Surgeons of England, held on March 13, with Sir Hugh Lett, Bt., President, in the chair, Prof. A. W. Sheen, Mr. W. H. Brown, Prof. John Morley, and Prof. P. J. Moir were elected Members of the Court of Examiners.

The title of Professor of Human and Comparative Anatomy was conferred upon Dr. A. J. E. Cave.

Mr. Eardley Holland was re-elected as the representative of the College on the Central Midwives Board.

Diplomas

Diplomas of Fellowship were granted to the following candidates:

J. E. Richardson, H. Freeman, T. I. Hughes, J. P. Reidy, Katharine M. H. Branson, Janet E. Bottomley, W. W. Wiggins-Davies, Dorothy M. S. Knott, H. L. Brewer, W. N. Campbell, L. Henry, C. W. Maclay, H. Rees, V. N. Singh, A. A. Wearn.

A Diploma of Membership was granted to Mohamed Abdul Hafeez of Osmania University and West London Hospital.

Diplomas in Tropical Medicine and Hygiene were granted, jointly with the Royal College of Physicians of London, to the following candidates:

F. I. C. Apted, M. A. Cave, M. A. X. Cochemé, J. J. Dubash, C. L. Ferguson, Brenda Fife, G. D. Harthan, Sara Joelson-Syrop, W. N. Kenrick, H. L. Maclure, D. H. Manson-Bahr, P. J. Pablot, A. E. Seligmann, D. B. Sen, S. B. Sinha, L. H. Turner, W. J. Tyson, A. J. Walker, C. Wilcocks.

Diplomas in Ophthalmic Medicine and Surgery were granted, jointly with the Royal College of Physicians of London, to the following candidates:

H. S. Grewal, F. J. Lorriman, A. Philipp.

The Services

AWARDS AND MENTIONS IN DISPATCHES

Captain Geoffrey Ollivant Brooks, R.A.M.C., has been awarded the George Medal for conspicuous gallantry in carrying out hazardous work in a very brave manner.

Lieut. William Sillar, R.A.M.C., has been awarded the Military Cross in recognition of distinguished services in the field.

Surgeon Commander Francis Laird Cassidi, V.D., R.N.V.R., has been awarded the Volunteer Officers' Decoration.

Surgeon Lieut.-Commander Gavin H. Cameron, R.A.N.R., has been awarded the Royal Naval Volunteer Reserve Officers' Decoration.

Temporary Surgeon Lieuts. Hamish Alexander Wallace, R.N.V.R. (posthumous), and Daniel Jack Wilkes, R.N.V.R., have been mentioned in dispatches for courage and devotion to duty.

CASUALTIES IN THE MEDICAL SERVICES

ROYAL NAVY

Missing

Surgeon Lieut. Lyon Ramsay Blair, R.N.

ARMY AWARDS

Corrigenda

In the list of officers whose names have been brought to notice in recognition of distinguished services in connexion with operations in the field, March to June, 1940, published in the *Journal* of January 4, two names were misspelt and the initials of five others were wrongly given. Major J. Houston, R.A.M.C., and Lieut. N. C. Rodgers, R.A.M.C., should read Major J. Huston, R.A.M.C., and Lieut. N. C. Rogers, R.A.M.C., and the initials of Captain (Acting Major) A. G. Whitfield, R.A.M.C., Captain L. Evans, R.A.M.C., and Lieuts. W. G. J. Gordon, C. Hope, and J. H. Rose, R.A.M.C., should read Captain (Acting Major) A. G. W. Whitfield, R.A.M.C., Captain L. F. Evans, R.A.M.C., and Lieuts. D. G. J. Gordon, G. H. G. Hope, and J. D. Rose, R.A.M.C.

The Colyer Prize was founded in 1926 to commemorate the twenty-five years' service of Sir Frank Colyer as honorary curator of the Odontological Museum. The accumulated income of this fund may be used every third year for a prize for the best original work in dental science, completed during the previous five years, by a dental surgeon educated at any recognized dental school in Great Britain or Northern Ireland, who has not been qualified to practise more than five years at the date of the award. Applications from candidates for the fourth award should be submitted by September 30, together with a general account of their researches, both completed and in progress, to the secretary, Royal Society of Medicine, 1, Wimpole Street, W.1, and marked "Colyer Prize."

Medical Notes in Parliament

The Parliamentary Medical Committee met at the House of Commons on February 8, when Dr. John McMichael of the Postgraduate Medical School, Hammersmith, and Dr. G. O. Barber, medical officer to Felsted School, opened a discussion on post-war medical planning. Debates followed on the future of medical practice. Sir Francis Fremantle was in the chair.

Overruled Decisions of Medical Boards

Dr. MORGAN asked on March 11 what were the general principles applied by the Army Medical Department when it overruled the opinion of civilian doctors in connexion with the examination of recruits for the Army and Auxiliary Territorial Service; when the overruling took place, at medical boards or subsequently; in how many cases the civilian medical opinion had been overruled; and had the civilian doctors been consulted before their opinion had been overruled. Captain MARGESSON said in reply that the opinion of civilian doctors regarding the physical fitness of recruits for the Army and the Auxiliary Territorial Service was overruled only after careful consideration of each individual case by the Army medical authorities, and, if necessary, after obtaining specialist advice. Apart from the examination of a recruit on joining, a disability might come to light during training: on the other hand, the conditions of Army life might improve the physical fitness of a recruit to such an extent as to justify transfer to a higher medical category. Information regarding the number of occasions on which the opinion of the Army medical authorities differed from that of the civilian medical board was not readily available. It was not considered practicable for administrative reasons to consult the civilian doctors on these occasions.

Adjustment in Industry

Dr. MORGAN declared on March 11 that a number of persons employed in war factories had been obliged to cease work owing to muscular strains and neuritis due to constant application to unaccustomed work and that they could not obtain any compensation or special remedial treatment for such injuries. He also said that in many industrial centres adequate and appropriate treatment facilities were non-existent. He asked what Mr. Ernest Bevin was doing to remedy this. Mr. BEVIN answered that in the majority of cases workers adjusted themselves to unaccustomed work after a short period and were not obliged to cease employment during the period of adjustment. He invited Dr. Morgan to give particulars of any contrary cases and promised to consider them.

Hospital Equipment under War Damage Bill

While the House of Lords was in Committee on the War Damage Bill on March 13 Lord LUKE said it was unlikely that hospitals would be as generously treated for equipment as for buildings. They would have to pay a premium for the insurance of the former, and he hoped that would be one which they could afford. They would like to insure a portion of the equipment if the hospital could not afford a premium on the whole. It was possible to carry on without *x*-ray equipment, but not without an operating theatre. He moved an amendment providing that in the insurance of goods held for charitable purposes the Board of Trade should consult a national, regional, or other body representing the purposes for which the goods were held.

Viscount SIMON, the Lord Chancellor, said the equipment of hospitals and other charitable bodies would be insurable under the business scheme and not under the private chattels scheme, and there would be no limit to the amount that could be covered. The definition of business was wide enough to cover the beneficent work of hospitals. The Board of Trade had consulted the Ministry of Health about hospitals, and the British Hospitals Association was in close touch with that Ministry. Any representations which still had to be made about hospitals would receive sympathetic attention. He gave an assurance that the Board of Trade would consult the Ministry of Health, if necessary, on any questions affecting hospitals which might arise in the administration of Part II of the Bill

and the Ministry would consult the British Hospitals Association. The Board of Trade had power to pay compensation although there had been no insurance. That power would be used to pay compensation for damage occurring before passage of the Bill. It was not intended to compensate hospitals for equipment not insured after the insurance scheme came into operation. Those for whom Lord Luke spoke should communicate with the Ministry of Health to find out which was the best way to proceed.

Lord LUKE withdrew his amendment and the Committee stage concluded.

Army Vaccination Instructions

Mr. VIANT asked on March 18 what instructions had been issued to Army medical officers in regard to the carrying out of vaccinations. Captain MARGESSON replied that the more important points in the instructions issued with regard to vaccination might be summarized as follow: (1) The individual must be in good health. (2) The skin over and around the site for vaccination should be cleansed. (3) The cleansed area must be allowed to dry thoroughly. (4) The vaccine lymph should be applied to this area before scarification is carried out. (5) Scarification should be made with a sharp-pointed scalpel, and should consist of a single linear incision one-quarter inch in length passing through the lymph. The incision should not be deep enough to draw blood. (6) Further scarification or energetic rubbing of the lymph into the incision should be avoided, as this tends to aggravate local reactions. (7) The dressing recommended is elastoplast, which should be applied after the lymph has been allowed to dry completely. Captain Margesson added that vaccination was carried out by scarification. One mark was produced. Revaccination was carried out at intervals of two, five, or seven years following successful vaccination according to local conditions.

Diphtheria in Immunized Edinburgh Children

At the request of Mr. JOHNSTON, the medical officer of health for Edinburgh has extracted from his records the following figures for the years 1938, 1939, and 1940. These figures are approximate, but complete statistics are now being kept for Edinburgh.

	1938	1939	1940
Approx. number of children immunized up to the end of the year	31,000	33,000	34,000
Number of immunized children who contracted diphtheria during the year ..	31	23	9
Number of fatal cases among these children in the year	1	—	—

Doctors' Identification Cards

Dr. MORGAN asked if the Minister of Health was aware of the ease with which doctors might obtain admission on demand to places of military importance without being required to produce evidence that they were in fact doctors. He asked whether the Minister would take steps to see that all doctors were provided, without delay, with identification cards containing their portraits and some authoritative indication that the portraits were those of medical practitioners, in view of the fact that the scheme already proposed for that purpose failed to operate except in comparatively few instances. Mr. ERNEST BROWN replied on March 12 that the majority of medical practitioners had already taken advantage of the special arrangements announced last October for the issue of authorized certificates of occupation. Those who had not done so were still at liberty to take advantage of these facilities. The Secretary for War and he were not satisfied that any need existed for further documents of identification for members of the medical profession. He was therefore not prepared to take the steps suggested by Dr. Morgan.

Staffing of E.M.S. Hospitals.—Dr. MORGAN inquired on March 6 whether, in view of the prevalence of influenza and other non-surgical complaints, Mr. Brown would see that physicians were appointed to those Emergency Medical Service Hospitals where such cases were at present under the care of surgeons. Mr. BROWN answered that the services of a specialist physician were available at every hospital in the emergency hospital scheme, although not necessarily on a resident basis.

Milk Supplies.—Mr. LIPSON asked on March 13 what steps were taken to ensure that an adequate supply of milk would be maintained. Mr. R. S. HUDSON answered that dairy cows received priority in the allocation of feeding stuffs under the rationing scheme. Every encouragement was given to dairy farmers in the ploughing-up campaign to become more self-supporting and to safeguard supplies of feed next winter by making silage and growing suitable fodder crops for their herds. In addition the Government recently announced prices for milk during the ensuing twelve months designed to maintain production at the highest level compatible with war conditions.

Medical Publishing and Reserved Occupations.—On March 18 Sir E. GRAHAM-LITTLE asked if the Minister of Labour would give consideration, in revising the Schedule of Reserved Occupations, to the necessity for retaining a sufficient number of employees of firms publishing medical and nursing books, a category in which fresh publications were demanded by the continuous advances in medicine and nursing. Mr. TOMLINSON said that it would not be practicable to place such publishing firms in a special category. If in any case it was regarded as important to retain the services of a particular individual, application for deferment could be made in the usual manner.

Medical News

A Chadwick Public Lecture on "Air Raid Shelters—Design and Construction, with Special Reference to Hygienic Considerations," will be delivered at the London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C., on Tuesday, April 8, at 2.30 p.m., when Dr. S. L. Wright will discuss hygienic considerations and Mr. Phillip O. Reece design and construction.

The sixty-first annual meeting of the Mental After-Care Association will be held in the rooms of the Royal Society at Burlington House, Piccadilly, W.1, on Tuesday, March 25, at 2.45 o'clock, under the presidency of Princess Arthur of Connaught. Among the speakers will be Colonel Henry Yellowlees, M.D., chairman of council. Anyone interested in the work of the association will be welcome.

The annual general meeting of the Central Council for the Care of Cripples will be held at Carnegie House, 117, Piccadilly, London, W., on Friday, March 28, at 2.30 p.m. An address will be given by the Right Hon. Ernest Brown, M.P., Minister of Health.

The next meeting of the Shaftesbury Military Hospital Medical Society will be held at the hospital on Tuesday, March 25, at 2.30 p.m., when there will be a discussion on "The Management of Battle Casualties in the Light of Modern Operational Tactics," to be opened by Colonel C. L. Franklin, A.M.S.

The Ling Physical Education Association (Hamilton House, Bidborough Street, W.C.1) is holding an Easter holiday course at the Bedford Physical Training College from April 15 to 18, when there will be many lectures and discussions on a variety of subjects as well as practical classes in the different branches of physical education. Medical, legal, and social welfare matters are among the subjects on which lectures will be given. Dr. Janet Aitken, senior physician, Elizabeth Garrett Anderson Hospital, is to speak on "Rheumatism in School Children," and Miss P. C. Colson on "The National Organization of Physical Recreation." There will be group discussions on "Problems of Rural Reception Areas," "Medical Inspection and the Gymnast," and other matters interesting to those concerned with education. Within a few days of the publication of the programme all the available places were filled.

The B.B.C. announces that "Health Magazine," a series of topical notes on wartime health—contributed mainly by doctors—will be continued on Fridays during April at 10.45 a.m. Two broadcasts in the daytime programmes for schools deal with medical history. The first, on April 1 at 1.50 p.m., in the series "Our Changing Countryside," tells the story of the village nurse from "Mrs. Gamp" to a public health service. It also describes the aeroplane ambulance in the Highlands. The second talk, on April 24 at 2.40 p.m., in the series "Movements and Men," describes how Elizabeth Garrett Anderson struggled to become a doctor and how she helped to open a path for other women.

No. 8

INFECTIOUS DISEASES AND VITAL STATISTICS

We print below a summary of Infectious Diseases and Vital Statistics in the British Isles during the week ended February 22, 1941.

Figures of Principal Notifiable Diseases for the week and those for the corresponding week last year, for : (a) England and Wales (London included). (b) London (administrative county). (c) Scotland. (d) Eire. (e) Northern Ireland.

Figures of Births and Deaths, and of Deaths recorded under each infectious disease, are for : (a) The 120 great towns in England and Wales (including London). (b) London (administrative county). (c) The 16 principal towns in Scotland. (d) The 13 principal towns in Eire. (e) The 10 principal towns in Northern Ireland.

A dash — denotes no cases ; a blank space denotes disease not notifiable or no return available.

Disease	1941					1940 (Corresponding Week)				
	(a)	(b)	(c)	(d)	(e)	(a)	(b)	(c)	(d)	(e)
Cerebrospinal fever	434	21	70	1	12	586	27	134	3	1
Deaths		4	7				10	9		
Diphtheria	1,042	54	352	26	26	734	30	192	64	23
Deaths	31	1	6	2	1	31	2	5	2	—
Dysentery	202	36	31		—	63	2	28		—
Deaths			—	—	—			—	—	—
Encephalitis lethargica, acute	5	—	2	—	—	6	1	—	—	—
Deaths		—	—				—	2		
Enteric (typhoid and paratyphoid) fever	25	4	5	—	1	6	1	—	—	1
Deaths	—	—	—	—		—	—	—	—	—
Erysipelas			57	7	1			63	5	8
Deaths		—	—				—	—		
Infective enteritis or diarrhoea under 2 years	31	4	8	9	2	31	4	7	4	7
Deaths										
Measles	14,976	269	176		19	4,793	93	126		316
Deaths	14	1	2	—	—	8	—	—	—	16
Ophthalmia neonatorum	76	2	16	1	—	82	5	20	—	—
Deaths										
Pneumonia, influenzal	1,874	89	53	11	12	2,280	110	109	10	14
Deaths (from influenza)	314	26	13	3	8	629	59	84	20	28
Pneumonia, primary			446	10				443	17	
Deaths		107		18	20		124		43	31
Polio-encephalitis, acute	2	—				—	—			
Deaths		—					—			
Poliomyelitis, acute	29	—	1		—	8	1	1		—
Deaths		—	—				—	—		
Puerperal fever	1	1	19	—	—	2	2	3	2	—
Deaths		—					—			
Puerperal pyrexia	150	7	32		—	152	10	22		4
Deaths										
Relapsing fever	—	—			—	—	—			—
Deaths										
Scarlet fever	1,238	53	172	28	30	1,174	38	132	50	67
Deaths	1	—	—	—	—	4	—	—	—	1
Small-pox	—	—	—	—	—	—	—	—	—	—
Deaths	—	—	—	—	—	—	—	—	—	—
Typhus fever	—	—	—	2	—	—	—	—	—	—
Deaths			—	—	—			—	—	—
Whooping-cough	3,258	59	597		19	521	13	18		7
Deaths	34	—	13	1	1	6	—	1	1	—
Deaths (0–1 year)	411	50	57	34	25	389	59	119	43	28
Infant mortality rate (per 1,000 live births)										
Deaths (excluding stillbirths)	6,891	1,019	837	250	196	9,494	1,427	1,085	364	324
Annual death rate (per 1,000 persons living)			18.2	16.6	17.2			20.7	2.43	28.4
Live births	4,818	345	839	309	222	6,595	1,027	912	345	244
Annual rate per 1,000 persons living			17.0	20.5	19.4			18.5	23.0	21.4
Stillbirths	210	15	37			305	37	49		
Rate per 1,000 total births (including stillborn)			42					51		

EPIDEMIOLOGICAL NOTES

Infectious Diseases for the Week

For the week ending February 22, scarlet fever, whooping-cough, cerebrospinal fever, and dysentery all increased in incidence in England and Wales ; generally speaking, these diseases were also more prevalent in London, with the exception of scarlet fever and cerebrospinal fever, and in Scotland with the exception of cerebrospinal fever. Since the week ending February 22 notifications have begun to diminish in number ; February 22, 434 ; March 1, 400 ; March 8, 370 : it is hoped that this downward trend will continue. At present fifty out of the total sixty-one administrative areas in the whole country are involved, notably Lancaster 61 ; Yorks, West Riding, 37 ; Glamorgan 36 ; London 21 ; Warwick 20 ; Middlesex 19 ; Essex 17 ; Chester 15 ; Gloucester 14 ; Durham, Southampton, and Stafford 13 each ; Kent 12 ; Derby and Surrey 10 each. In Scotland twenty-three counties or boroughs are affected, chiefly the counties of Lanark 4, and Berwick 3 ; and the boroughs of Glasgow 21, Edinburgh 6, and Aberdeen and Paisley 3 each.

Dysentery

Dysentery is present in nineteen administrative areas, but over four-fifths of the cases occurred in six areas—namely, Yorks. West Riding, 51 (Bradford 20, Sheffield 12, Wakefield 11, Wortley R.D. 19, Aireborough U.D. 1) ; Essex 39 (Colchester 34, Brentwood U.D. 5) ; London 36 (Wandsworth 24, St. Marylebone 4, Chelsea and Finsbury St. Pancras 2 each, Hampstead and Stepney 1 each) ; Lancaster 25 (Manchester 5, St. Helens 1, Lancaster M.B. 6, Preston R.D. 4, Whiston R.D. 3, Warrington R.D. 2, Prestwich M.B. 1) ; Dorset 16, in Weymouth and Melcombe Regis M.B.

Influenza

In the week ended March 8, 199 deaths were ascribed to influenza in the 126 great towns—68 fewer than in the previous week. Of these deaths, 6.5% were at ages under 25 and 55.8% at ages over 65. In the County of London the deaths decreased from 20 to 13 ; the proportion of total deaths coming from the South-Eastern Area was 35.6%. This is the third week of decline in total mortality, and it is highly probable that the winter epidemic has spent its force.

Typhus Fever

Two cases of typhus fever were notified during the week in Clifton R.D., Co. Galway, and reports have since been received that between February 17 and 26, 23 cases of this disease have been admitted to hospital in this locality. Precautions taken to prevent spread appear to have been successful and there have been no deaths.

Registrar-General's Return for Northern Ireland for the Quarter Ended December 31, 1940

During the quarter 5,490 births (2,851 males, 2,639 females) were registered, equivalent to an annual rate of 16.9 per 1,000 of the estimated population, or 1.5 below the average for the corresponding quarters for the preceding five years. Illegitimate births were 4.4% of the total. There were 3,991 deaths (2,077 males, 1,914 females), corresponding to an annual rate of 12.3, or 1.4 below the average rate for 1935–9. Infant mortality was 73 per 1,000 births, compared with 67 for 1940 and an average of 76 for the five preceding years.

Leon J. Aries (*Surgery*, 1941, **9**, 51), as a result of experimental studies with synthetic fibre (nylon) as a buried suture, concludes that nylon has all the good qualities of silk and in addition is stronger and less irritating. It may be boiled several times without losing its original tensile strength. He found that a multifilament nylon was flexible, easily handled, and threaded without difficulty on fine needles. This suture approximated tissues without cutting through, and in fascia and muscle did not cause as much irritation as silk. Experiment on hollow viscera showed the same properties, and the use of nylon in attaching such viscera to the abdominal wall did not result in fistulous tracts.

Letters, Notes, and Answers

All communications in regard to editorial business should be addressed to THE EDITOR, BRITISH MEDICAL JOURNAL, B.M.A. HOUSE, TAVISTOCK SQUARE, W.C.1.

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QUERIES AND ANSWERS

How are Road Accident Injuries Caused ?

Lieut.-Colonel J. A. A. PICKARD, D.S.O. (general secretary, the Royal Society for the Prevention of Accidents, 52, Grosvenor Gardens, S.W.1), writes: Are road accident injuries mainly due to impact with the vehicle or with the road or by crushing? In factories, injuries due to being struck by reciprocating machinery such as cranks have been lessened by facing such moving parts with sorbo rubber. It has been suggested to us that if the bumpers and wings of motor vehicles were similarly treated the severity of injuries from road accidents would be reduced considerably. I should greatly appreciate the medical view on this point.

Ca'cium Lactate

Dr. J. A. BROWN (Birmingham) writes: Mr. A. J. Hobson's prescription (February 1, p. 182) becomes "thick and valueless" because it contains excess of $CaCO_3$, resulting in a mixture of calcium lactate and calcium carbonate. The following prescription contains calcium lactate grains xv in each dose, and will remain clear and active for ten to fourteen days:

℞	Calcii carb.	ʒiij
	Ac. lactic. pur.	ʒj
	Aq. .. .. ad	ʒviij

F.M. Sig.: ʒss t.d.s., p.c.

Mix the $CaCO_3$ with two ounces of water in a wide measure; shake well; add lactic acid slowly. The mixture is of great value in the prevention and treatment of chilblains and in the treatment of urticaria. Preventive treatment of chilblains should be commenced in October, ʒss t.d.s. for a week, ʒss bis die subsequently. I have not tried the effect of this treatment for dysmenorrhoea.

Jam from Rose Hips

Dr. MARGARET D. WRIGHT (Hammersmith) writes in reply to Dr. W. J. Burns Selkirk (March 15, p. 426): To every pound of hips allow 1/2 pint of water. Boil till the fruit is tender and pass the pulp through a fine sieve to keep back the seeds. Add 1 lb. of sugar to 1 lb. of pulp and boil till it jellies. No hips should be used for jam until they have been touched by frost. Either an enamel-lined or glass oven-ware saucepan *must* be used.

Treatment of Night Sweats

Dr. MICHAEL G. GOOD writes in reply to "J. N. T." (March 8, p. 389): In a patient suffering from heavy night sweats and slightly raised temperature a tuberculous lesion can be excluded only after an *x*-ray investigation of the chest and an examination of the sputum, if present, are negative. For the relief of night sweats I recommend barbitone 5 grains taken at bedtime or, alternatively, phenobarbitone 1/2 grain t.d.s.

A Case of Cow-pox

Dr. J. HOBART NIXON (Chippenham) writes: The description given by Dr. McCloy, March 8 (p. 362), suggests to me that though cow-pox is common in man (as Jenner knew), his case may be one of foot-and-mouth disease in the human being. This will be confirmed by an outbreak of foot-and-mouth disease in the cloven hoof animals in the district and disseminated irregularly on various farms. The veterinary profession is not unanimous on the incidence of foot-and-mouth disease in man, though it has been proved by cases quoted by Prof. J. A. Nixon and myself, investigated in Wilts and Somerset, and later confirmed by outbreaks of the disease in the district, to be of more frequent occurrence than suspected, as the older generation of farmers knew and cured. The death rate in cattle is about 2%, but the infectivity is so high that the slaughter policy of the Government is justified. But why not produce a race of cattle immune to foot-and-mouth disease, as can be scientifically done?

Income Tax

Salary and Allowances

"A. B." is working under the E.M.S. scheme and receives a salary of £550 and allowances of £100. Is he liable on the £100?

*** Yes, if it is received in cash, as apparently it is.

Cars Destroyed by Bombs

"H." possessed two cars, A and M, for which running costs and depreciation were allowed. Both were destroyed by one bomb. Another M car was then hired with option to purchase, but this also was hit by a bomb almost at once. The owner accepted as compensation the wrecks of the two M cars. The A car was sold for £5. Since then another A car has been bought for £30. How should these disasters be reflected in the income tax return?

*** The return for 1940–1 will not be affected; the allowances to be claimed in making the return for a subsequent year are as follows. (In so far as the claim ranks as an expense it will affect the profit of the professional year—that is, to December 31—in which the loss occurred.)

(*a*) Obsolescence allowance as an expense incurred when the car was replaced (i) for the first A car—value of the car as written down after deduction of the 1940–1 depreciation allowance less the £5 for which it was sold. The maximum allowance is the £30 expended; (ii) for the first M car the whole of the written-down value should be recorded for future reference: no claim can be made until the car is replaced. (*b*) Depreciation allowance on the second M on its estimated capital value and the second A car on its cost—that is, £30—for the period during which they were used.

LETTERS, NOTES, ETC.

Paratyphoid in Infancy

Dr. F. O. CLARKE (Blackpool) writes: In your issue of March 8 (p. 385) there is a notice of a case of paratyphoid A in a male infant aged 1 year. About eight years ago I had as a patient a female infant under 1 year suffering from paratyphoid B. The infant was artificially fed. In the same house there were two young girls suffering from paratyphoid B, confirmed by agglutination test. In the case of the infant I did not have an agglutination test done, as the symptoms and signs were diagnostic, including a few rose spots. It would be interesting to know if the case of paratyphoid B is also "remarkable owing to the rarity of the disease at that age."

Hay-fever Desensitization

Dr. SINCLAIR MILLER (Harrogate) writes: For several years past I have had an opportunity of observing the benefit derived from an intensive course of a polyvalent grass-pollen vaccine in the prevention of hay-fever attacks. The course of inoculations is usually started in March, the initial dose of the vaccine being dependent on the reaction to a skin sensitization test. The patient is taught to give his own injections, following a technique similar to that used for insulin, and various dilutions of the vaccine are supplied in rubber-capped bottles so that the patient can readily increase each succeeding dose—a 15% increase on the previous dose is the standard accepted. The injections are generally given daily, though occasionally twice daily if the commencement of the course has been delayed. In most cases an end dose of 100,000 units is reached before the last week of May, when injections are stopped. In practically all cases coming under a full course of inoculations there has been complete desensitization to pollen and freedom from hay-fever symptoms for the current year. By the following springtime sensitization has returned, though generally to a less degree, and a further course of inoculations is required.

Cleansing the Shelters

One of the problems connected with public air-raid shelters is that of adequate cleansing. It appears that local authorities have to spend large sums of money, and to use numbers of men who can ill be spared, for this admittedly important work. Experiments have therefore been carried out by the Health and Cleanliness Council (Aldwych House, W.C.2) with an electric floor-cleaning apparatus, capable of washing thoroughly and drying 3,000 superficial feet an hour. The experiments were so successful that it is proposed to put a mobile cleansing unit on the road at an early date. This unit will comprise an electric floor scrubber working from light or power laid on in the shelter or from a generator on the van. It is hoped to include in the service unit electrical sprays for the suppression of vermin, etc.